IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TENNESSEE
CHATTANOOGA DISTRICT

MICHIGAN MOTOR TECHNOLOGIES LLC Plaintiff, v. VOLKSWAGEN AKTIENGESELLSCHAFT and VOLKSWAGEN GROUP OF AMERICA, INC., Defendants.	No. [_____] **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

Michigan Motor Technologies LLC ("MMT" or "Plaintiff"), for its Amended Complaint against Defendants Volkswagen Aktiengesellschaft ("VWAG" or "Defendant") and Volkswagen Group of America, Inc. ("VWGOA" or "Defendant") (collectively "Defendants"), alleges the following:

NATURE OF THE ACTION

1. This is an action for patent infringement arising under the Patent Laws of the United States, 35 U.S.C. § 1 et seq.

THE PARTIES

2. Plaintiff is a Limited Liability Company organized under the laws of the State of Michigan with a place of business at 2360 Orchard Lake Road, Suite 100, Sylvan Lake, Michigan 48320.

3. Upon information and belief, Volkswagen Aktiengesellschaft is a Corporation organized and existing under the laws of Germany, with its principal place of business at Berliner Ring 2, 38440 Wolfsburg, Germany.

4. VWAG is a multinational corporation which designs, manufactures, and sells vehicles spanning twelve brands: Volkswagen Passenger Cars, Volkswagen Commercial Vehicles, Audi, Porsche, Bentley, Bugatti, Lamborghini, Ducati, Scania, Man, Seat, and Skoda. Upon information and belief, VWAG exercises control over the production plant at 8001 Volkswagen Drive, Chattanooga, TN 37416 where it is the sole supplier and service provider for VWGOA.

5. Upon information and belief, Volkswagen Group of America, Inc. is a Corporation organized and existing under the laws of the State of New Jersey and a wholly owned subsidiary of Volkswagen Aktiengesellschaft. Volkswagen Group of America, Inc. has its principal place of business at 2200 Ferdinand Porsche Dr., Herndon, VA 20171.

6. On information and belief, Defendant VWGOA has a place of business at 8001 Volkswagen Drive, Chattanooga, TN 37416, where Defendants manufacture their products.

7. Defendant VWAG exercises control over Defendant VWGOA, its wholly-owned subsidiary, with a unity of interest and ownership such that VWGOA is a mere instrumentality of its parent Volkswagen AG, including through the following actions:

a. VWAG is the parent company of the Volkswagen Group, which controls various subsidiaries and organizations, including VWGOA. (Exhibit 1, VW 2019 Annual Report at 57.)

b. VWAG develops vehicles and components for the Group's brands. (Ex. 1 at 57.)

c. VWAG's Board of Management is the ultimate body responsible for managing the Group. The Supervisory Board appoints, monitors and

advises the Board of Management; it is consulted directly on decisions that are of fundamental significance for the Company. (Ex. 1 at 57.)

d. Each brand in the Volkswagen Group is managed by a brand board of management. (Ex. 1 at 58.) The board adheres to the Group targets and requirements laid down by the Board of Management of Volkswagen AG. (*Id*.) The Supervisory Board advises and monitors the Board of Management with regard to the management of the Company and is directly involved in decisions of fundamental importance to the Company. (*Id*. at 57-58.)

e. There is no differentiation between VWAG and its subsidiaries in its financial reporting to its shareholders (Ex. 1 at 195-202); its performance goals (*Id.* at 51-54); its sales and distribution figures (*Id.* at 195); or its global compliance initiatives. (*Id.* at 65.)

f. Volkswagen Group has a global compliance organization which comprises divisional and regional compliance offices. (Ex. 1 at 65.) It supports and advises the respective Group and brand companies with an effective, risk-based, Group-wide compliance management system, helping them to conduct their business activities in accordance with the rules and to consistently

g. adhere to relevant laws and internal regulations. (Ex. 1 at p. 65.)

h. VWAG sells its USA Warranty and Maintenance to consumers, thereby purposefully contracting with citizens in this jurisdiction. (Exhibit 2, VWAG USA Warranty and Maintenance at 2.)

JURISDICTION AND VENUE

8. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

9. This court has subject matter jurisdiction under 28 U.S.C. §§ 1331 (Federal Question) and 1338(a) (Patent Law).

10. Venue is proper in this judicial district under 28 U.S.C. § 1400(b). On information and belief, Defendants have committed acts of infringement in this District and have regular and established places of business within this District.

11. Defendants' unlawful infringement of MMT's patents was committed in this jurisdiction. Defendants manufacture and sell the Accused Instrumentalities from and within this jurisdiction and engage in related business transactions thereby purposefully availing themselves of the laws of the State of Tennessee and this jurisdiction. As such, Defendants are subject to this Court's general and specific personal jurisdiction.

12. Defendants have sufficient minimum contacts within the State of Tennessee and this District, pursuant to due process and/or the Tennessee Long Arm Statute. Defendants purposefully availed themselves of the privileges of conducting business in the State of Tennessee and in this District because Defendants regularly conduct and solicit business within the State of Tennessee and within this District and because Plaintiff's causes of action arise directly from Defendants' business contacts and other activities in the State of Tennessee and this District.

PATENTS IN SUIT

13. Plaintiff is the owner by assignment of a portfolio of patents, including the four patents described in detail in the counts below (collectively "the Asserted Patents").

14. U.S. Patent Nos. 6,581,574 ("the '574 patent"), 6,609,497 ("the '497 patent"), 6,557,540 ("the '540 patent"), and 6,736,122 ("the '122 patents") were assigned to Plaintiff, MMT on August 28, 2017.

15. MMT is the rightful owner of the Asserted Patents and hold the entire right, title and interest in the Asserted Patents.

16. MMT brought suit against Defendants on February 19, 2019 in the United States District Court for the Eastern District of Michigan ("the Michigan Litigation"). The Asserted Patents were included in this original complaint.

17. On September 27, 2019, Defendants moved to limit the number of patents MMT could assert in the Michigan Litigation to 10. On December 12, 2019 the court in the Michigan Litigation granted in part Defendants motion to limit the number of patents and ordered MMT to file a second amended complaint.

18. The Asserted Patents were not included in the MMT's second amended complaint filed in the Michigan Litigation.

19. Between July 2, 2019 through May 12, 2020, Defendants filed *Inter Partes Review* ("IPR") petitions for each of the patents originally asserted against Defendants in the Michigan Litigation notwithstanding that some of the patents were no longer part of the Michigan Litigation by virtue of the second amended complaint.

20. Defendants requested institution of an IPR for the '547 patent on or about July 2, 2019.

21. On January 21, 2020, the Patent Trial and Appeal Board refused to institute an IPR for the '547 patent.

22. Defendants requested institution of an IPR for the ’497 patent on or about November 27, 2019.

23. On May 26, 2020, the Patent Trial and Appeal Board refused to institute an IPR for the ’497 patent.

24. Defendants requested institution of an IPR for the ’540 patent on or about November 25, 2019.

25. On June 5, 2020, the Patent Trial and Appeal Board refused to institute an IPR for the ’540 patent.

26. Defendants requested institution of an IPR for the ’122 patent on or about December 20, 2019.

27. On July 6, 2020, the Patent Trial and Appeal Board refused to institute an IPR for the ’122 patent.

28. Thus, the Patent Trial and Appeal Board denied instituting IPRs for all of the Asserted Patents.

29. On information and belief, the previous owner of the Asserted Patents sent a letter to Defendants describing the Accused Patents and seeking a license from Defendants for the Asserted Patents (“the Previous License Offer Letter”).

30. This letter was sent prior to August 28, 2017, the date MMT acquired the Asserted Patents.

31. Defendants refused to take a license with the previous owner of the Asserted Patents.

32. Defendants’ attorneys in the Michigan Litigation confirmed that Defendants had received the Previous License Offer Letter in discussions with MMT’s attorneys.

33. Based on comments from Defendants' attorneys on multiple occasions, it is clear that their instructions have been to litigate in such a manner as to cause delay and increase costs.

34. Thus, Defendants have been aware of the Asserted Patents since they were made aware of the Asserted Patents prior to August 28, 2017 by the previous owners, but at least as late as February 19, 2010 when MMT filed the complaint in the Michigan Litigation asserted the Asserted Patents.

COUNT I – INFRINGEMENT OF U.S. PATENT NO. 6,581,574

35. The allegations set forth in the foregoing paragraphs 1 through 34 are incorporated into this first Claim for Relief.

36. On June 24, 2014 the '574 patent entitled "Method for Controlling Fuel Rail Pressure," was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the '574 patent is attached as Exhibit 3.

37. Plaintiff is the assignee and owner of the right, title and interest in and to the '574 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

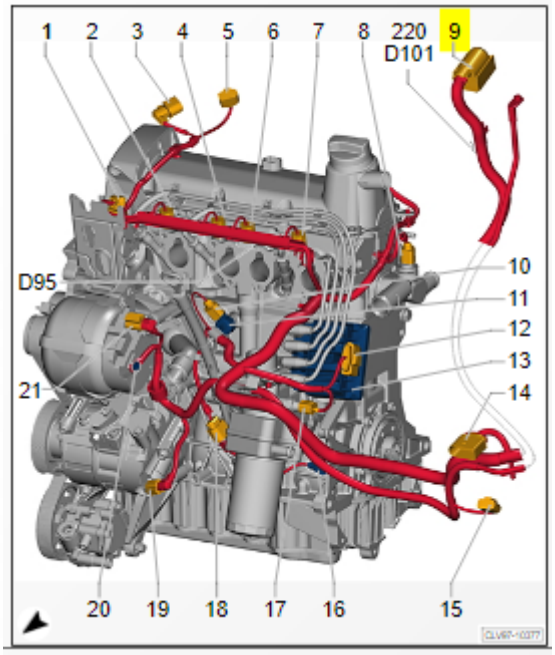
38. Defendants were made aware of the '574 patent prior to August 28, 2017 when it received the Previous License Offer Letter, and as late as February 19, 2019 when MMT filed its complaint in the Michigan Litigation.

39. Upon information and belief, Defendants have and continue to directly infringed at least claims 1 and 7 of the '574 patent by making, using, selling, importing and/or providing and causing to be used the 2015-2018 Jetta (1.4L) or other vehicles having incorporated the DTI engine ("the '574 patent Accused Instrumentalities").

40. In particular, claim 1 of the '574 patent recites a method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an

internal combustion engine comprising: providing a set-point fuel pressure; providing the estimated average fuel flow through the system; generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow; measuring the fuel rail pressure with a fuel pressure sensor; filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors; comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure; and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor.

41. On information and belief, the ’574 patent Accused Instrumentalities infringe claim 1 of the ’574 patent. The ’574 patent Accused Instrumentalities practice a method of controlling (*Figure 1*) the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine (*Figure 1*) comprising: providing a set-point fuel pressure (*Figure 1*); providing the estimated average fuel flow through the system (*Figure 2*); generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow (*Figure 3*); measuring the fuel rail pressure with a fuel pressure sensor (*Figure 4*); filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors (*Figure 5*); comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure (*Figure 6*); and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor (*Figure 7*).



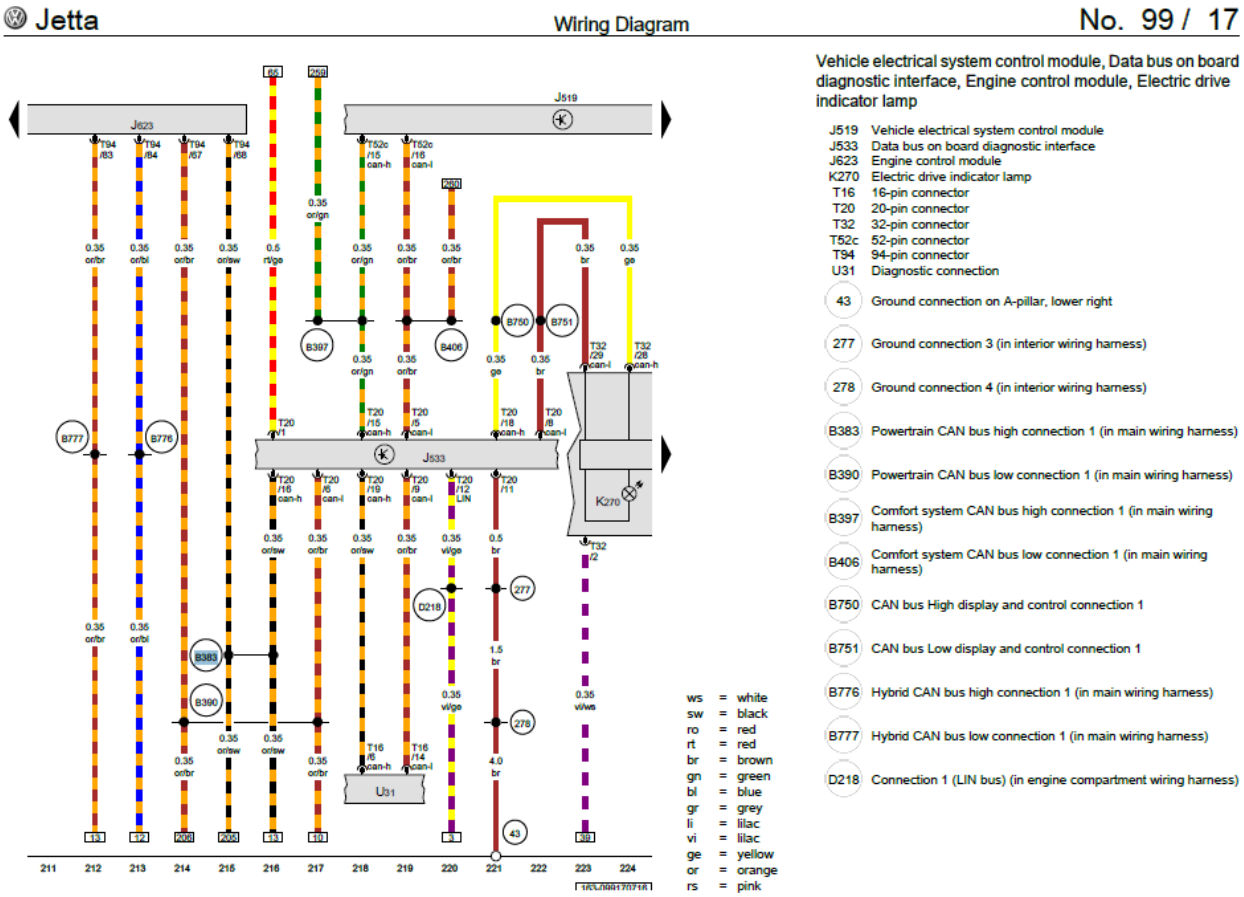
For example, the 1.4LTSI engine is an internal combustion engine.

As demonstrated in the exemplary images above (9) and below, the ’574 patent Accused Instrumentalities comprise an Engine Control Module (ECM; 9; J623) and Powertrain CAN bus (B383, B390) which practice a method of controlling the fuel delivery system in conjunction with a fuel rail pressure sensor (1).

Oxygen sensor 1 before catalytic converter, Heated oxygen sensor, Engine control module, Cylinder 1 fuel injector, Cylinder 2 fuel injector, Cylinder 3 fuel injector, Cylinder 4 fuel injector

GX10	Oxygen sensor 1 before catalytic converter
G39	Heated oxygen sensor
J623	Engine control module
N30	Cylinder 1 fuel injector
N31	Cylinder 2 fuel injector
N32	Cylinder 3 fuel injector
N33	Cylinder 4 fuel injector
T2cg	2-pin connector
T2ch	2-pin connector
T2ci	2-pin connector
T2cj	2-pin connector
T6w	6-pin connector, in the engine compartment, rear
T60	60-pin connector
T94	94-pin connector
Z19	Oxygen sensor heater
H1	Positive connection (in oxygen sensor wiring harness)

07.2016



The Fuel Pressure regulator valve (8; N276) controls the pressure of the fuel flow directly into the fuel rail and therefore, to the fuel injectors in accordance with the ECM signal based on engine conditions.

2016 Volkswagen Jetta Sedan (163) L4-1.4L Turbo (CZTA)

Vehicle » Powertrain Management » Fuel Delivery and Air Induction » Fuel Pressure Regulator » Testing and Inspection

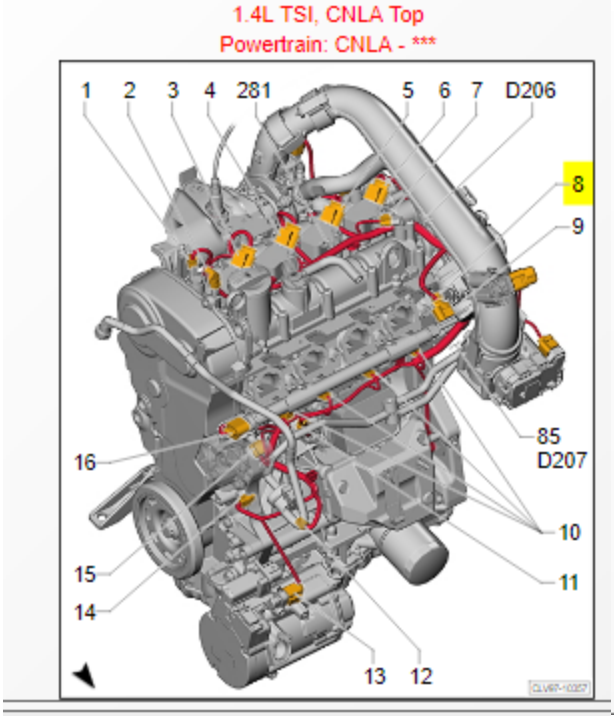
TESTING AND INSPECTION

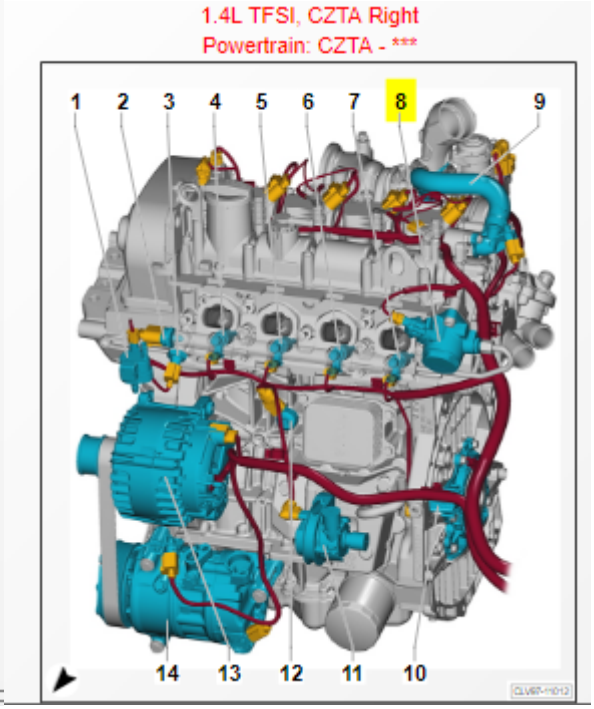
Fuel Pressure Regulator Valve (N276), Checking

General Description

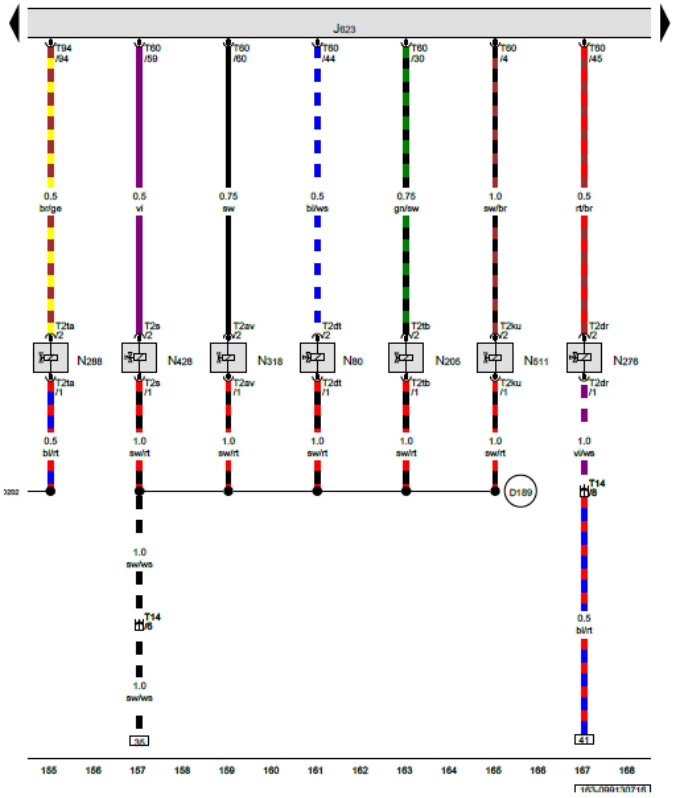
The Engine Control Module (J623) regulates the Fuel Pressure Regulator Valve (N276) directly at the High Pressure Fuel Pump to control the low pressure valve inside the High Pressure Fuel Pump.

Source: ALLDATA Pro





Jetta — Wiring Diagram — No. 99 / 13



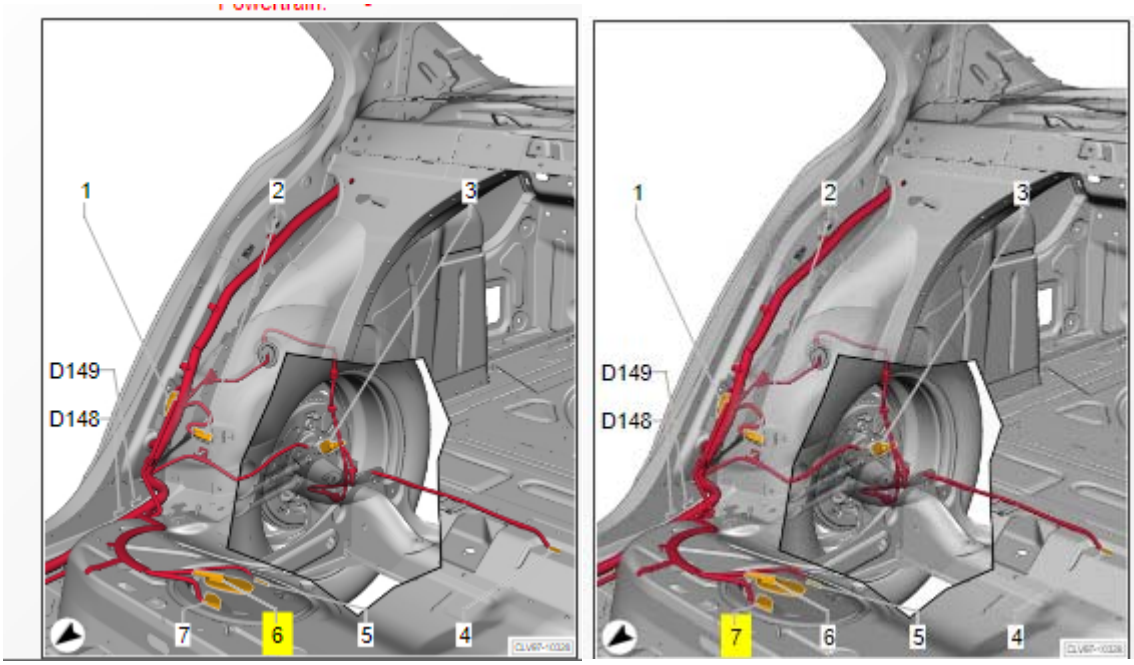
Engine control module, EVAP canister purge regulator valve 1, Camshaft adjustment valve 1, Fuel pressure regulator valve, Exhaust camshaft adjustment valve 1, Oil pressure regulation valve, Decoupler pressure actuator

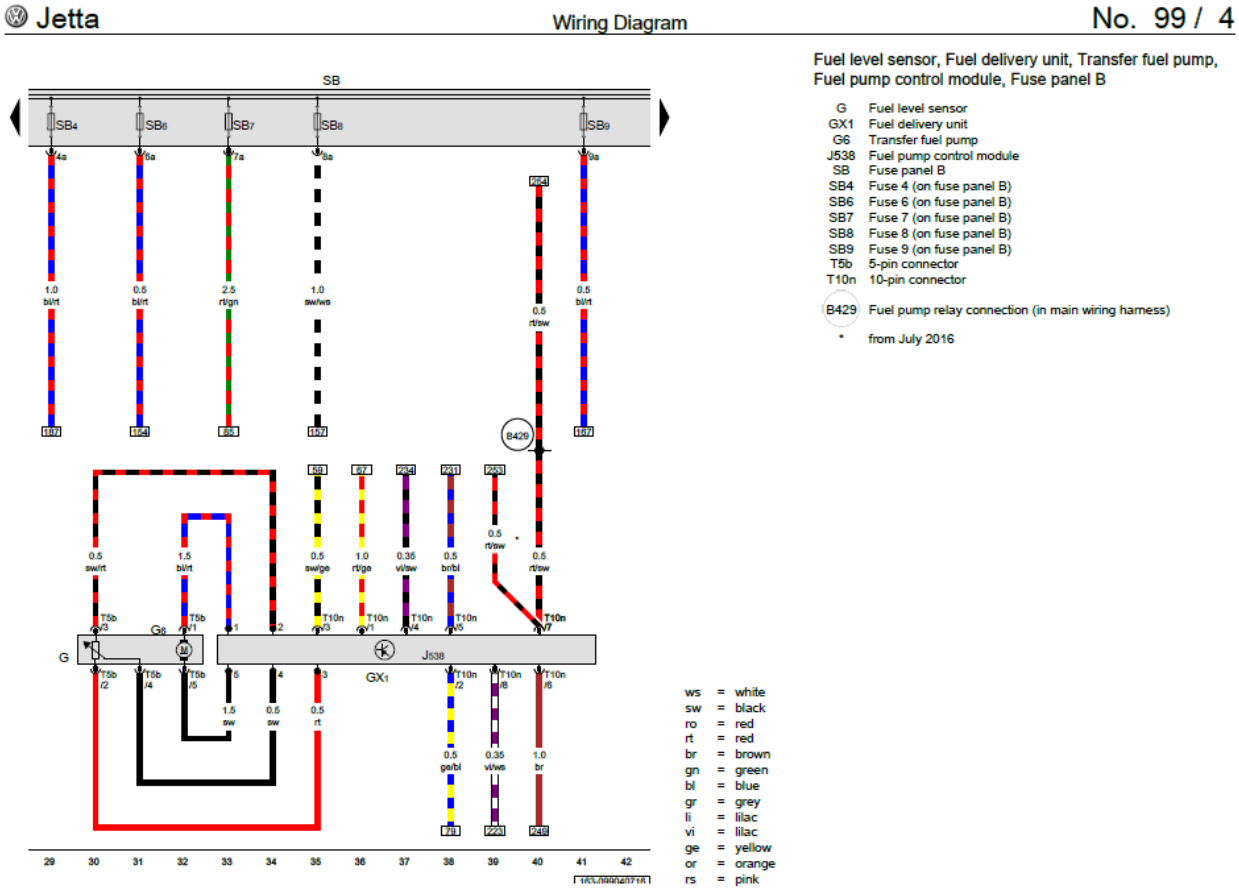
J623	Engine control module
N80	EVAP canister purge regulator valve 1
N205	Camshaft adjustment valve 1
N276	Fuel pressure regulator valve
N288	Tank switch-off valve
N318	Exhaust camshaft adjustment valve 1
N428	Oil pressure regulation valve
N511	Decoupler pressure actuator
T2av	2-pin connector
T2dr	2-pin connector
T2dt	2-pin connector
T2ku	2-pin connector
T2s	2-pin connector
T2ta	2-pin connector
T2tb	2-pin connector
T14	14-pin connector
T60	60-pin connector
T94	94-pin connector
D189	Connection 87a (in engine pre-wiring harness)
D202	Connection 6 (87a) (in engine compartment wiring harness)

ws	=	white
sw	=	black
ro	=	red
rt	=	red
br	=	brown
gn	=	green
bl	=	blue
gr	=	grey
li	=	lilac
vi	=	lilac
ge	=	yellow
or	=	orange
rs	=	pink

07.2016

The ’574 patent Accused Instrumentalities comprise a Fuel delivery unit (6; GX1) and Fuel Pump Control Module (7; J538), which controls a fuel pump delivering fuel to a High-Pressure Fuel Pump, connected to a fuel rail of an internal combustion engine.





2016 Volkswagen Jetta Sedan (163) L4-1.4L Turbo (CZTA)

Vehicle » Powertrain Management » Fuel Delivery and Air Induction » Fuel Pump » Testing and Inspection » Fuel Delivery Unit (GX1)/Fuel Pump Control Module (J538), Checking

FUEL DELIVERY UNIT (GX1)/FUEL PUMP CONTROL MODULE (J538), CHECKING

Fuel Delivery Unit (GX1)/Fuel Pump Control Module (J538), Checking

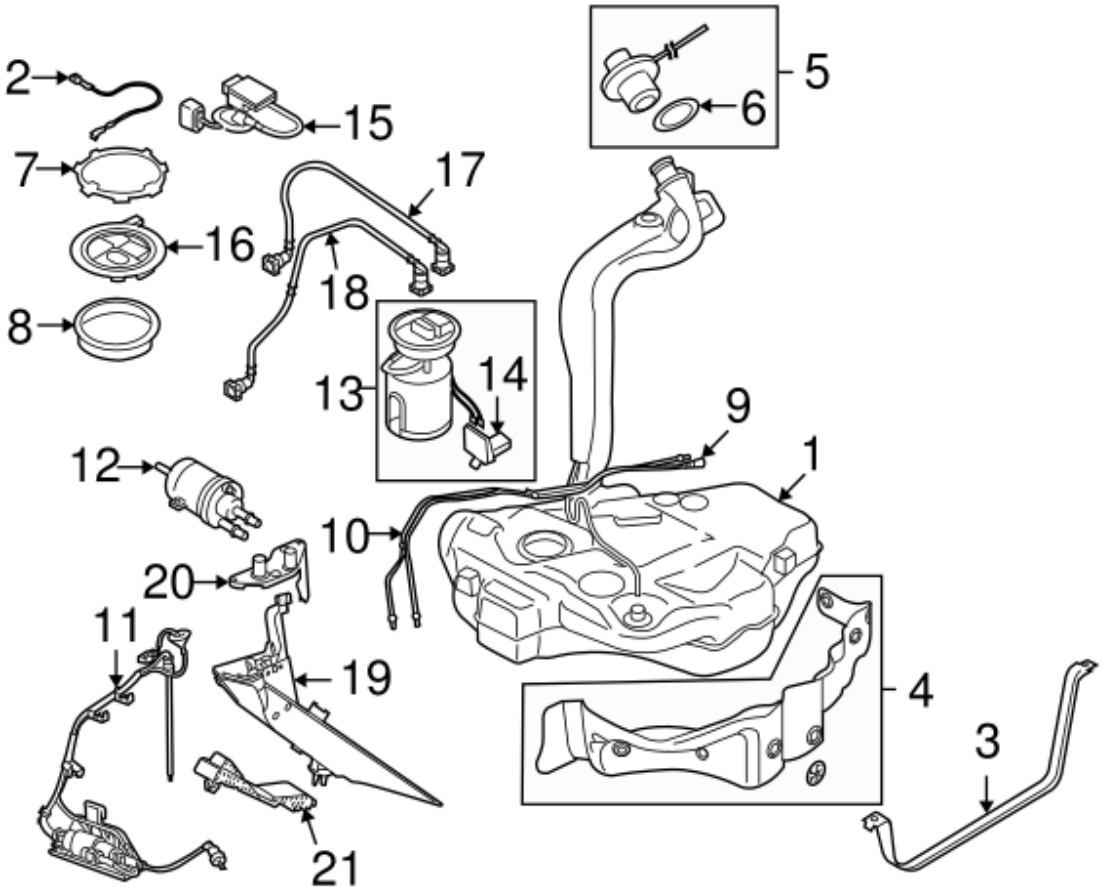
General Description

The Engine Control Module (J623) tells the Fuel Pump Control Module (J538) the demand needed for fuel volume and pressure and activates the Transfer Fuel Pump (G6). The Transfer Fuel Pump (G6) transfers fuel to the rest of the fuel system, where it is monitored by the Engine Control Module (J623) through sensors, and controlled through regulators and/or metering valves.

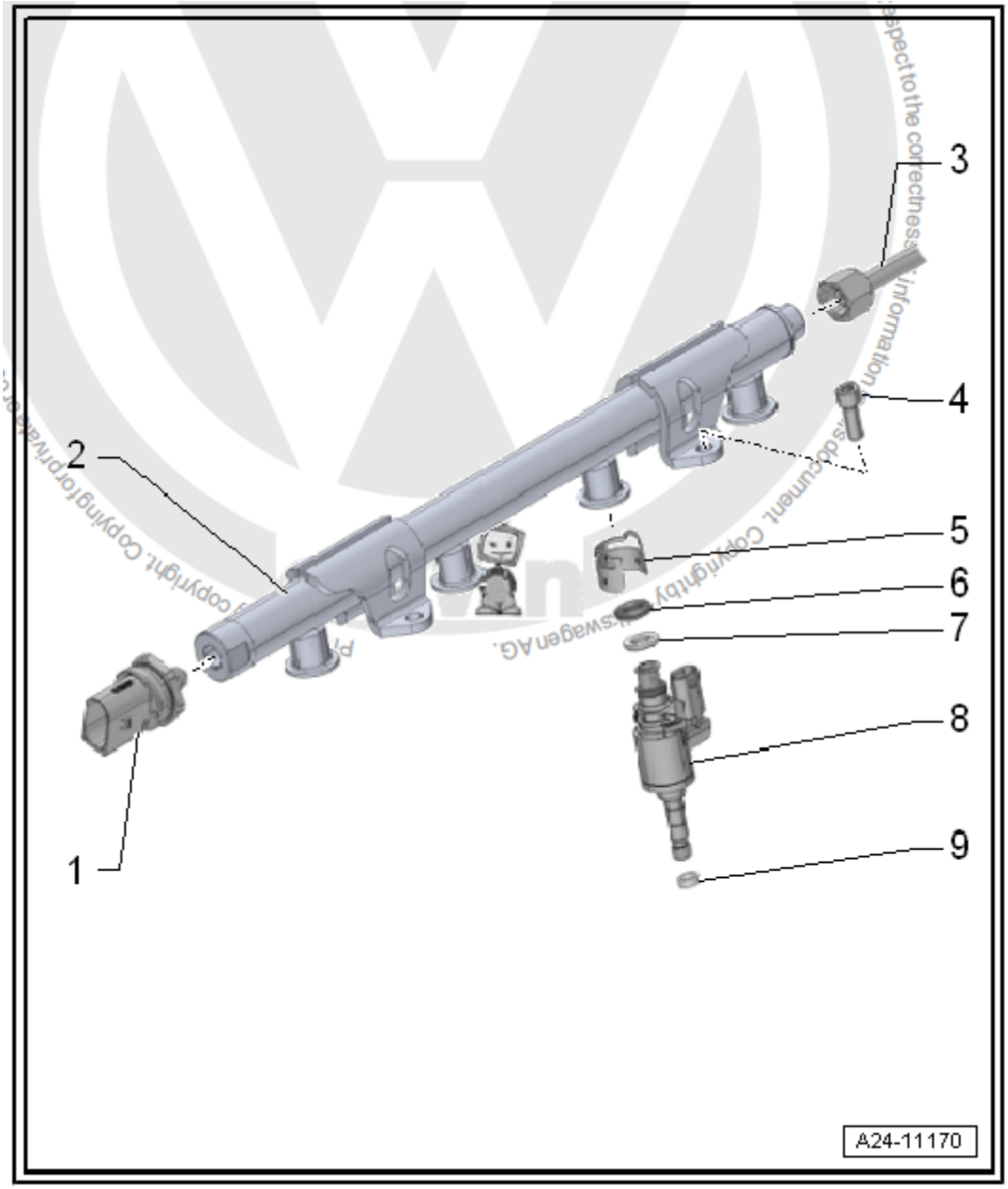
Source: ALLDATA Pro

http://212.62.78.144/iwire/i-wire_data.html?eslpUrl=MEX5R0106099

For example, the fuel pump (13) shown below, delivers fuel to a fuel rail (shown below) of a fuel delivery system.



https://www.worldoemparts.com/world-vw-parts/oem-parts/volkswagen-fuel-pump-assembly-seal-1j0919133b/?c=YT12b2xrc3dhZ2Vu



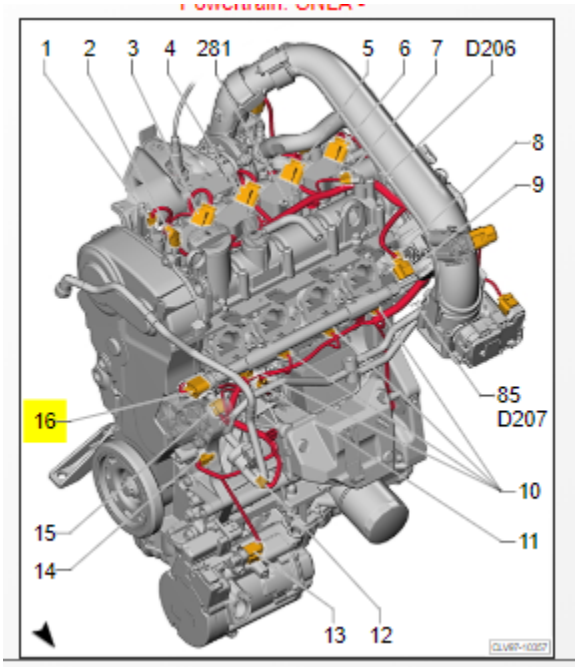
Jetta 2011 ➤ , Jetta 2015 ➤ 4-Cylinder Direct Injection (1.4L Engine, 4V, EA 211, Turbocharger, Hybrid) - Edition 12.2017

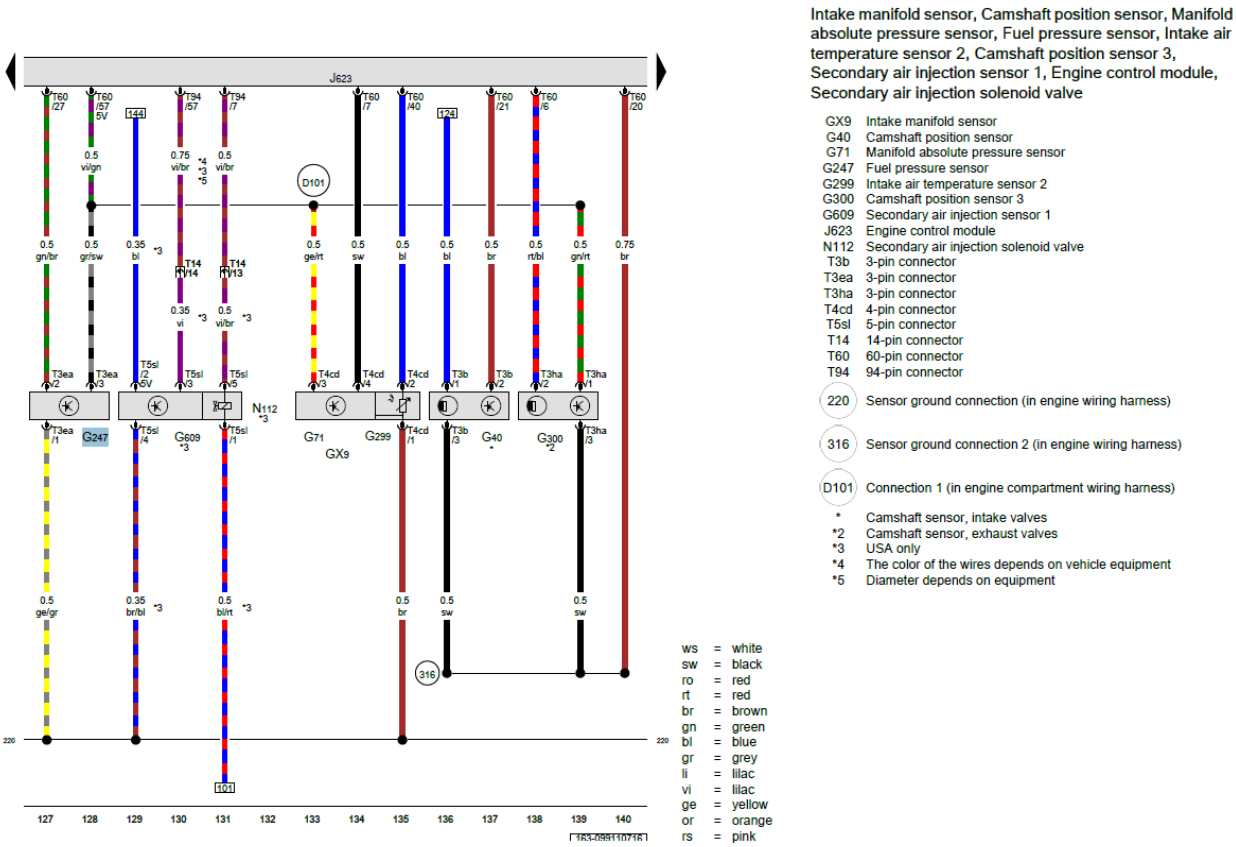
Upon information and belief, the fuel (rail) pressure sensor (1), shown immediately above, measures the fuel pressure in the delivery pipe. The fuel (rail) pressure sensor converts the pressure to a voltage signal. The ECM (J623 shown above) uses this signal to control the correct fuel rail pressure and adjusts the fuel pressure regulator valve (8; N276), shown above, if the target or set-point fuel pressure calculated by the ECM and the actual pressure measured by the rail pressure sensor are different (the difference being used to derive an error signal which is used for controlling the fuel pump motor.

Figure 1

The average fuel flow is calculated by the ECM and based upon injector pulse width and fuel pressure of the fuel rail (2) shown above.

Figure 2





Upon information and belief, the ’574 patent Accused Instrumentalities generate a feed forward control signal via the ECM (J623) based upon the set-point fuel pressure (target pressure) and the average fuel flow (embodied in the average efficiency curve of fuel consumption). The feed forward signal is generated by the ECM/PCM software.

Figure 3

The ’574 patent Accused Instrumentalities practice a method of measuring the fuel rail pressure with a fuel rail pressure sensor pictured below (1).

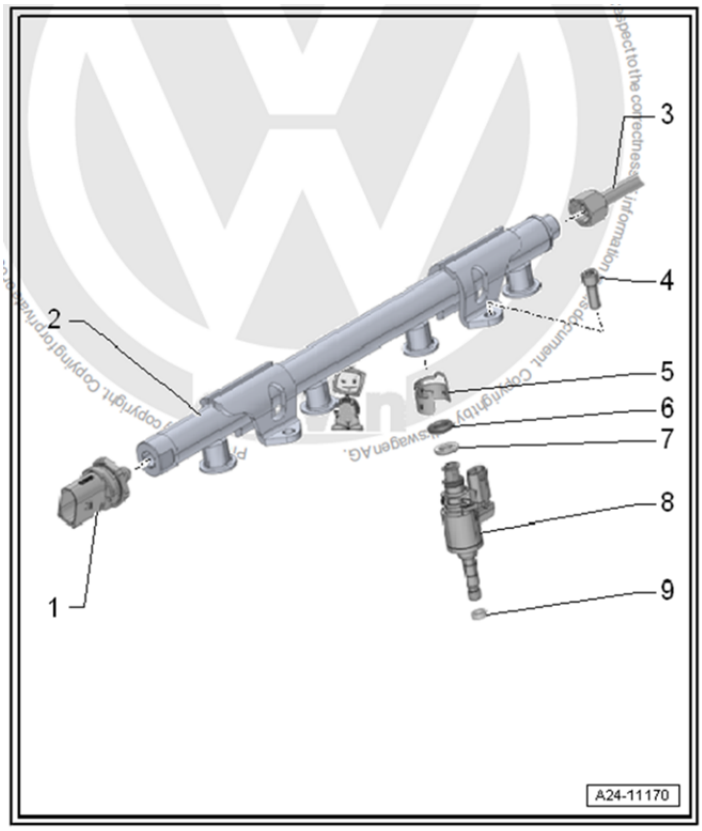
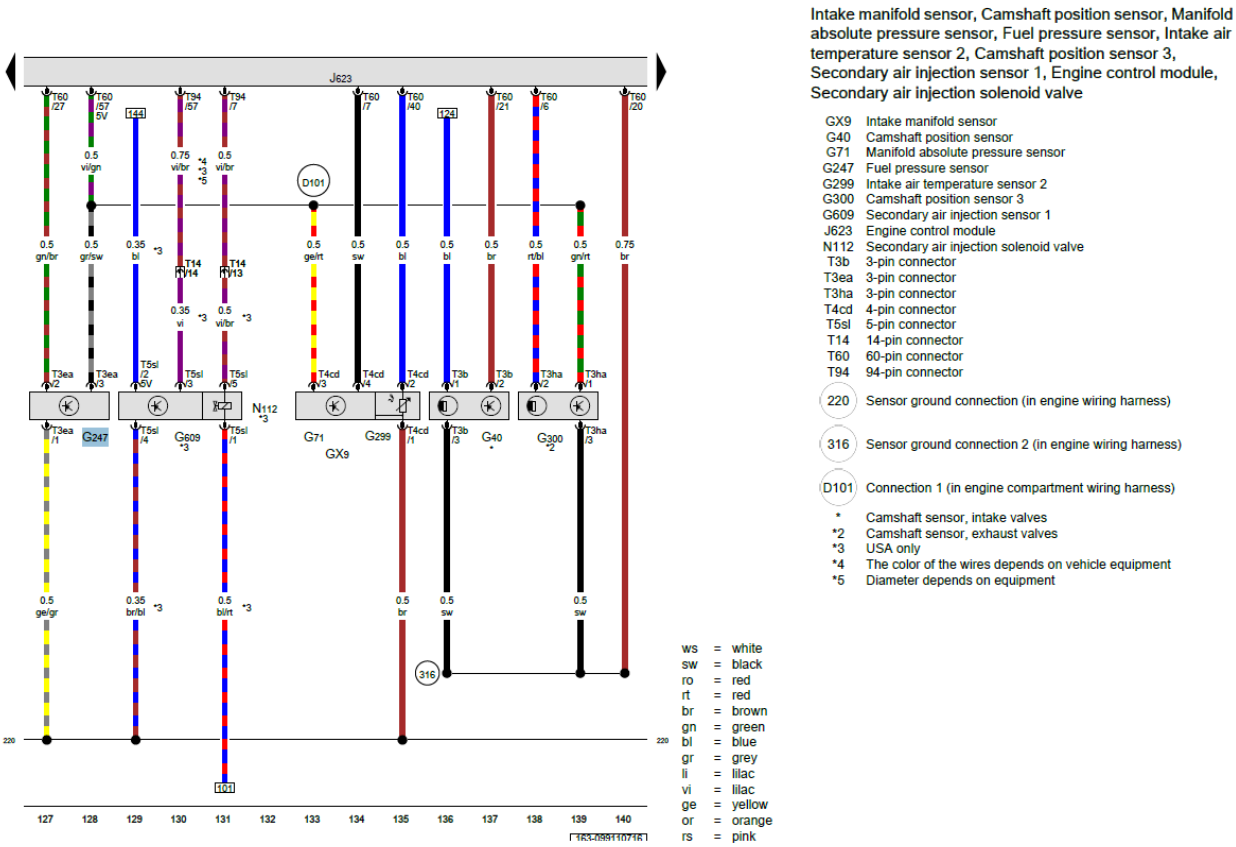


Figure 4

Upon information and belief, the ECM (J623) filters the output of the fuel rail pressure sensor (1 above); thereby it also filters out the pulses detected from the fuel rail pressure sensor to thereby filter the output of the fuel rail pressure sensor (1) in such a manner as to filter out pulses due to the opening and closing of the fuel injectors.



The raw output from the fuel pressure regulator valve (N276 (below)) reflects the pressure pulses of the fuel injectors, which are filtered by the ECM.

The ECM compares the fuel rail (actual) pressure to the set-point (target) fuel pressure and generates an error signal (Fault Code) P119A/004506 - Fuel Pressure Sensor (G247): Malfunction based upon the difference between the fuel rail pressure sensor output and the set-point fuel pressure calculated by the ECM.

Possible Causes

- Faulty Fuel Pressure Sensor (G247)
- Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Faulty HPFP
- Faulty (leaking) fuel injector

http://wiki.ross-tech.com/wiki/index.php/P119A/004506

http://wiki.ross-tech.com/wiki/index.php/P119A/004506

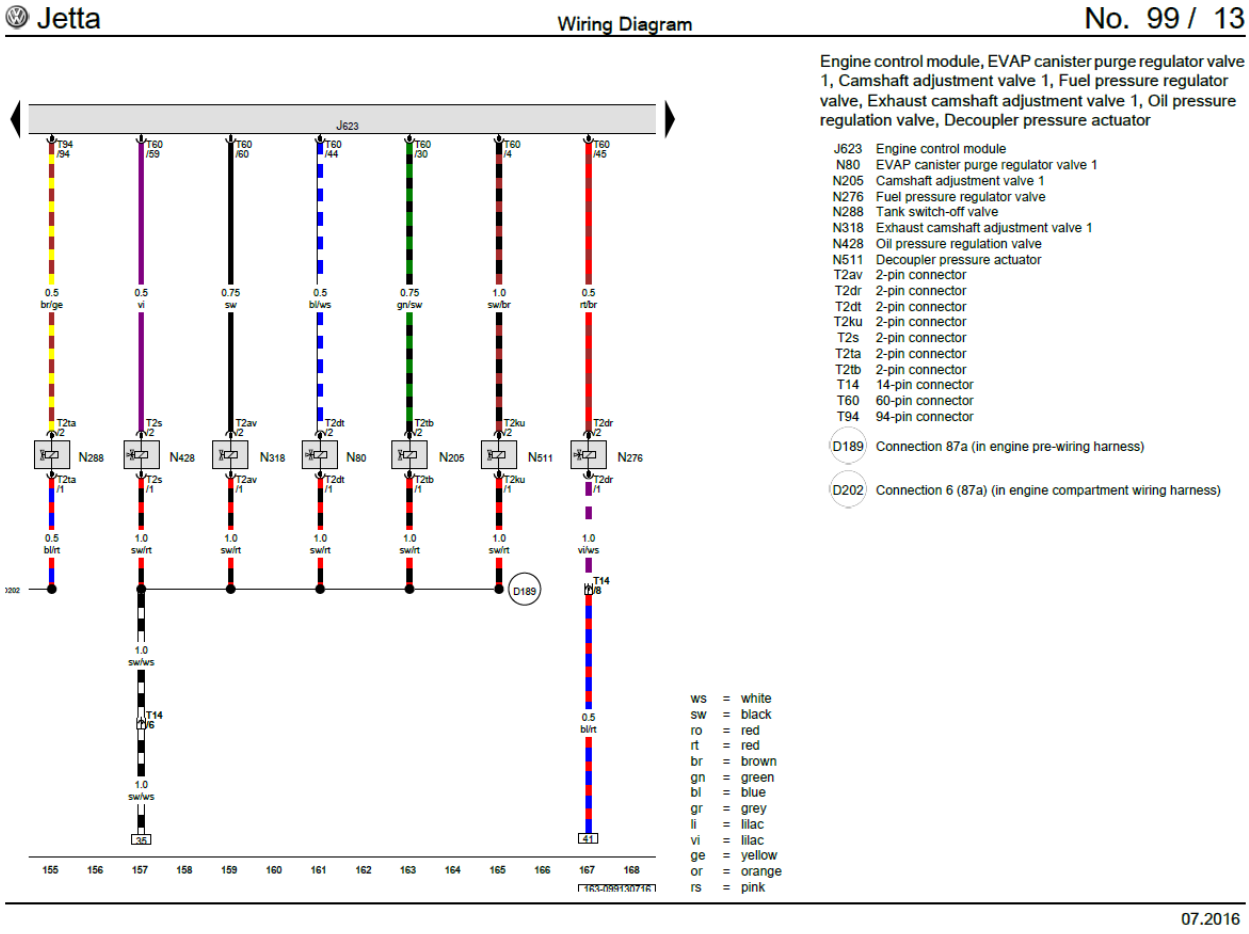
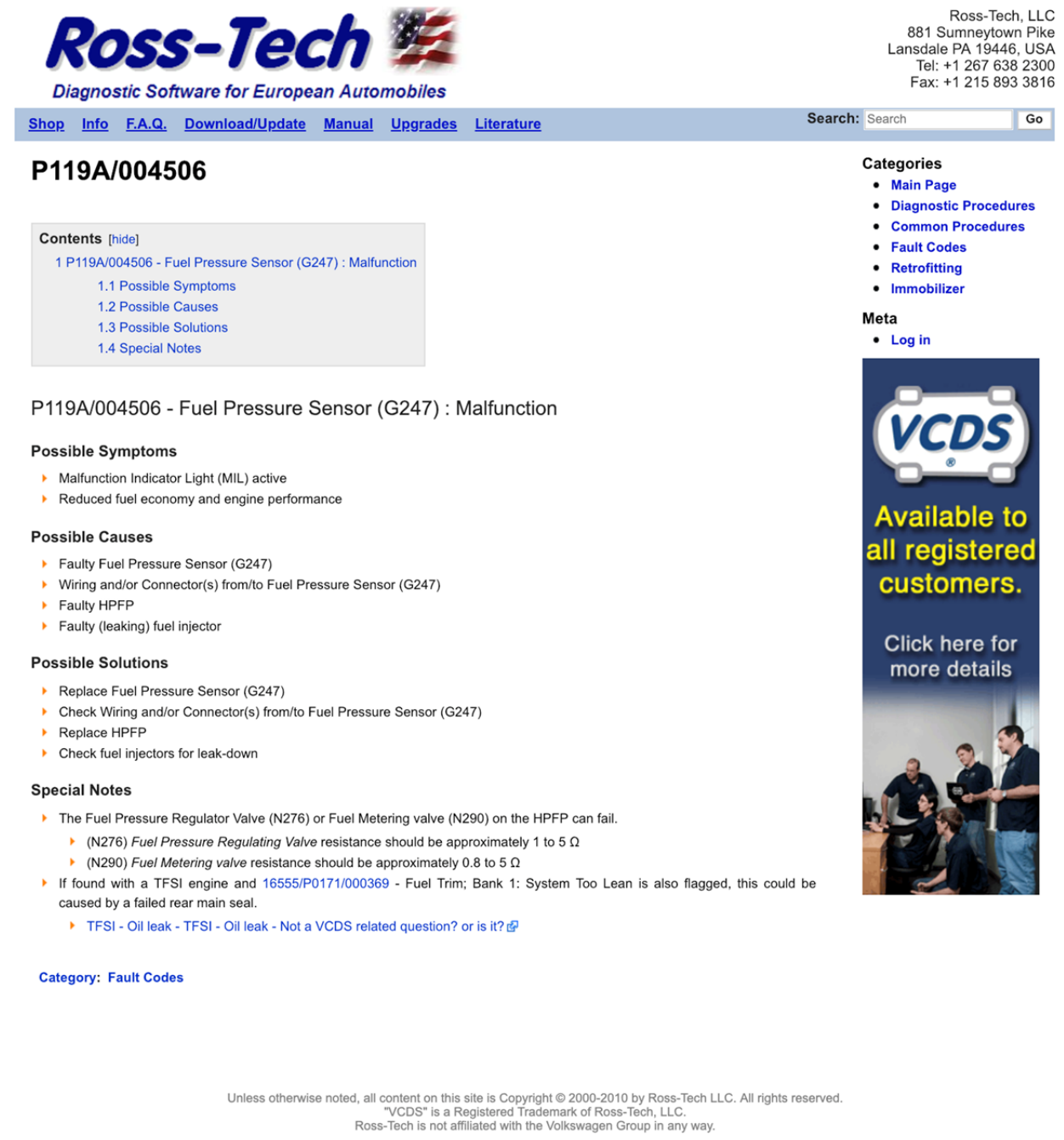


Figure 5

Possible Causes

- Faulty Fuel Pressure Sensor (G247)
- Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Faulty HPFP
- Faulty (leaking) fuel injector

http://wiki.ross-tech.com/wiki/index.php/P119A/004506



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P119A/004506

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1 P119A/004506 - Fuel Pressure Sensor (G247) : Malfunction
1.1 Possible Symptoms
1.2 Possible Causes
1.3 Possible Solutions
1.4 Special Notes

P119A/004506 - Fuel Pressure Sensor (G247) : Malfunction

Possible Symptoms
- Malfunction Indicator Light (MIL) active
- Reduced fuel economy and engine performance

Possible Causes
- Faulty Fuel Pressure Sensor (G247)
- Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Faulty HPFP
- Faulty (leaking) fuel injector

Possible Solutions
- Replace Fuel Pressure Sensor (G247)
- Check Wiring and/or Connector(s) from/to Fuel Pressure Sensor (G247)
- Replace HPFP
- Check fuel injectors for leak-down

Special Notes
- The Fuel Pressure Regulator Valve (N276) or Fuel Metering valve (N290) on the HPFP can fail.
  - (N276) *Fuel Pressure Regulating Valve* resistance should be approximately 1 to 5 Ω
  - (N290) *Fuel Metering valve* resistance should be approximately 0.8 to 5 Ω
- If found with a TFSI engine and 16555/P0171/000369 - Fuel Trim; Bank 1: System Too Lean is also flagged, this could be caused by a failed rear main seal.
  - TFSI - Oil leak - TFSI - Oil leak - Not a VCDS related question? or is it?

Category: Fault Codes

Categories
- Main Page
- Diagnostic Procedures
- Common Procedures
- Fault Codes
- Retrofitting
- Immobilizer

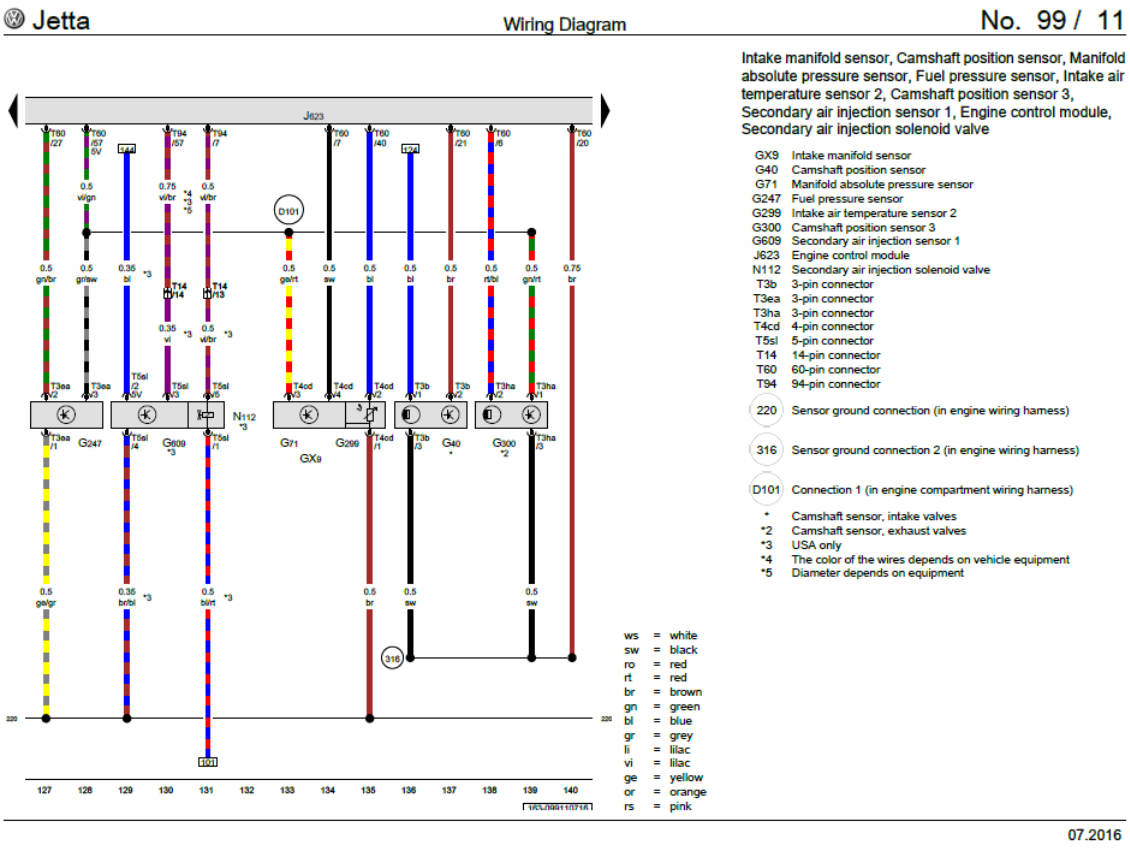
Meta
- Log in

http://wiki.ross-tech.com/wiki/index.php/P119A/004506

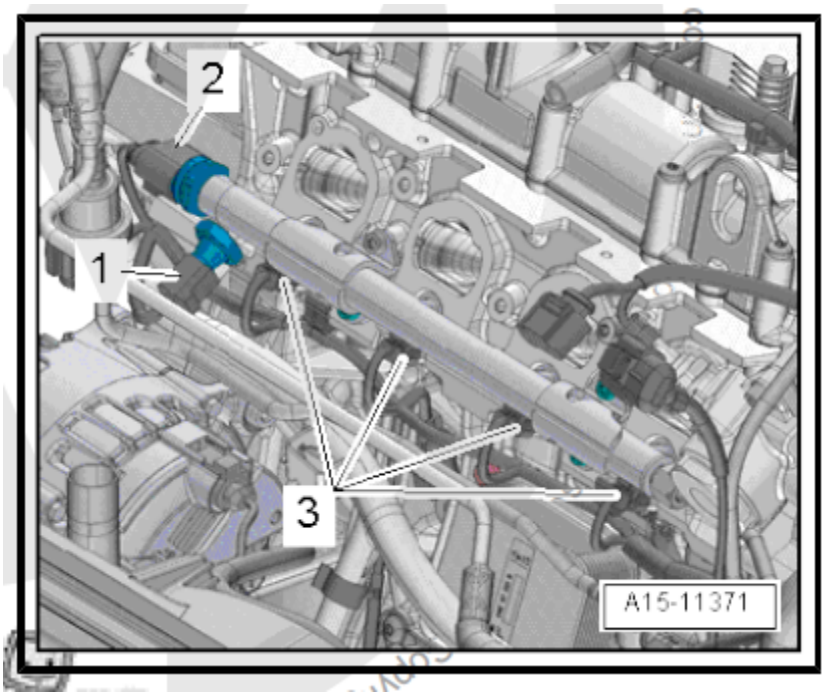
Figure 6

As demonstrated in the exemplary images below, the ’574 patent Accused Instrumentalities modify a feed forward control signal via the ECM (J623) and /or CAN Bus when the fuel (rail) pressure sensor (G247) detects a fuel pressure different from the set-point fuel pressure and

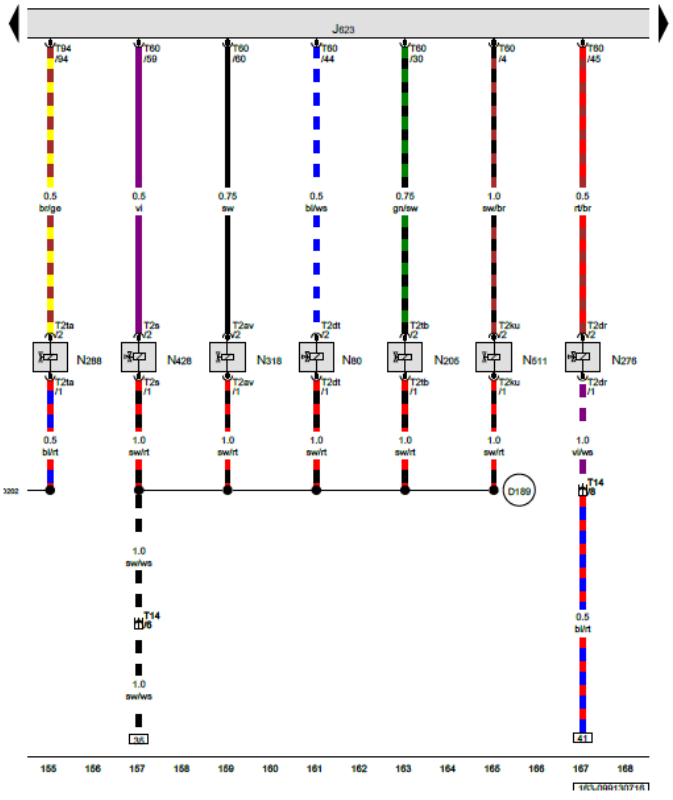
communicates that difference (error signal) to the ECM which in turn generates a control signal based upon that error signal to the fuel pump motor.



The fuel (rail) pressure sensor (2) installed on the fuel cylinder (fuel rail) and the fuel pressure regulator valve (N276) deliver the modified feed forward control signal based upon the error signal (received from the ECM (J623)) thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor controlled by the fuel pump motor control module (J538). This is accomplished via the fuel delivery unit (GX1) with the fuel pump control module (J538) controlling the fuel pump (G5).



Jetta | Wiring Diagram | No. 99 / 13



Engine control module, EVAP canister purge regulator valve 1, Camshaft adjustment valve 1, Fuel pressure regulator valve, Exhaust camshaft adjustment valve 1, Oil pressure regulation valve, Decoupler pressure actuator

J623	Engine control module
N80	EVAP canister purge regulator valve 1
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N428	Oil pressure regulation valve
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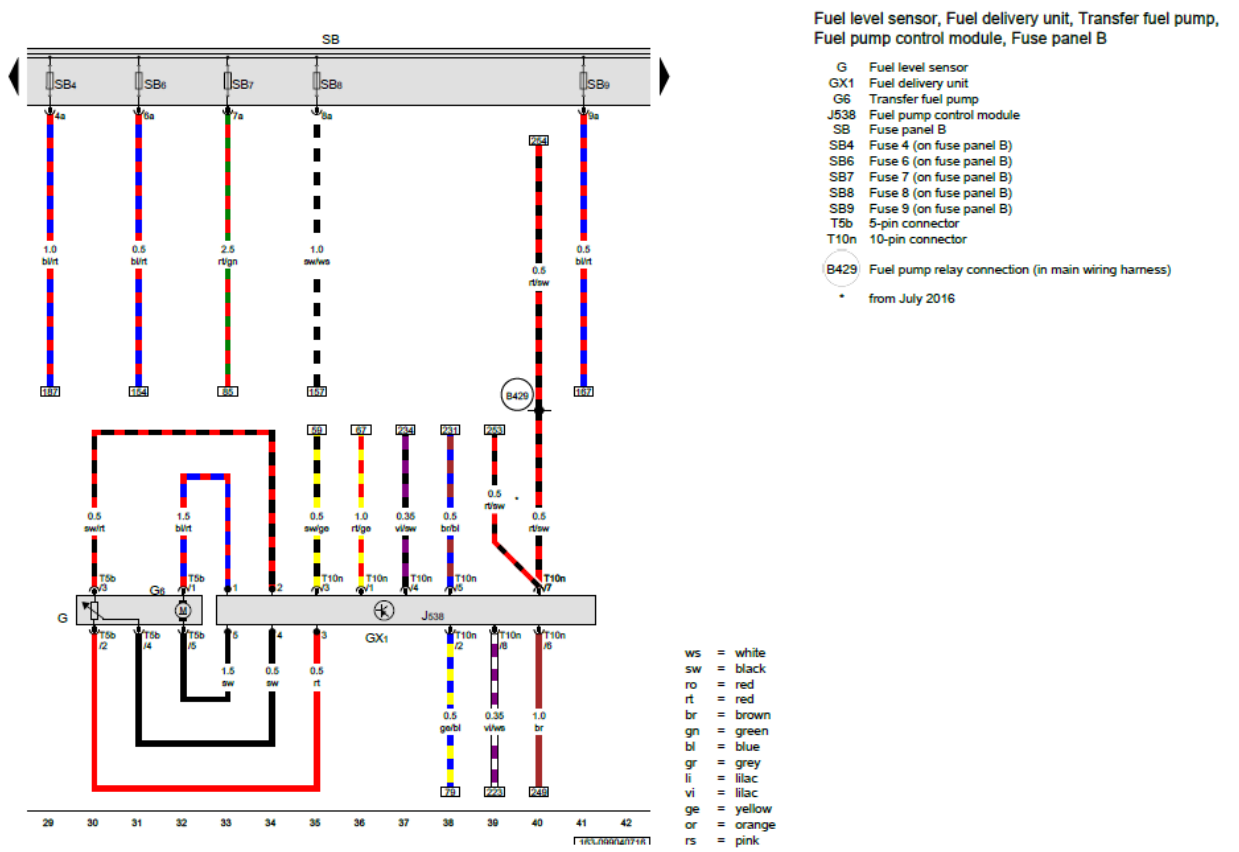
T2av	2-pin connector
T2dr	2-pin connector
T2dt	2-pin connector
T2ku	2-pin connector
T2s	2-pin connector
T2ta	2-pin connector
T2tb	2-pin connector
T14	14-pin connector
T60	60-pin connector
T94	94-pin connector
D189	Connection 87a (in engine pre-wiring harness)
D202	Connection 6 (87a) (in engine compartment wiring harness)

ws	=	white
sw	=	black
ro	=	red
rt	=	red
br	=	brown
gn	=	green
bl	=	blue
gr	=	grey
li	=	lilac
vi	=	lilac
ge	=	yellow
or	=	orange
rs	=	pink

07.2016



Based upon the totality of the foregoing evidence, and based further upon information and belief, the '574 patent Accused Instrumentalities practice "a method of controlling the fuel pressure within a fuel delivery system having a fuel pump which delivers fuel to a fuel rail of an internal combustion engine comprising: providing a set-point fuel pressure; providing the estimated average fuel flow through the system; generating a feed forward control signal based upon the set-point fuel pressure and the average fuel flow; measuring the fuel rail pressure with a fuel pressure sensor; filtering the output of the fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors; comparing the fuel rail pressure to the set-point fuel pressure and generating an error signal based upon the difference between the fuel rail pressure and the set-point fuel pressure; and modifying the feed forward control signal based upon the error signal thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor."

Figure 7

42. Claim 7 of the '574 patent recites a fuel delivery system comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the

opening and closing of the fuel injectors, and a fuel pump motor controller having: a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system; a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure; a feed back controller adapted to receive the error value and to generate a feed back control signal; a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal; and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

43. On information and belief, the ’574 patent Accused Instrumentalities infringe claim 7 of the ’574 patent. The ’574 patent Accused Instrumentalities comprise a fuel delivery system (*Figure 8*) comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle (*Figure 9*), a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure (*Figures 10-11*), a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors (*Figure 12*), and a fuel pump motor controller (*Figure 13*) having: a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system (*Figure 14*); a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail

pressure and the set-point fuel pressure (*Figure 15*); a feed back controller adapted to receive the error value and to generate a feed back control signal (*Figure 16*); a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal (*Figure 17*); and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal (*Figure 18*).

The ’574 patent Accused Instrumentalities comprise a fuel delivery system.

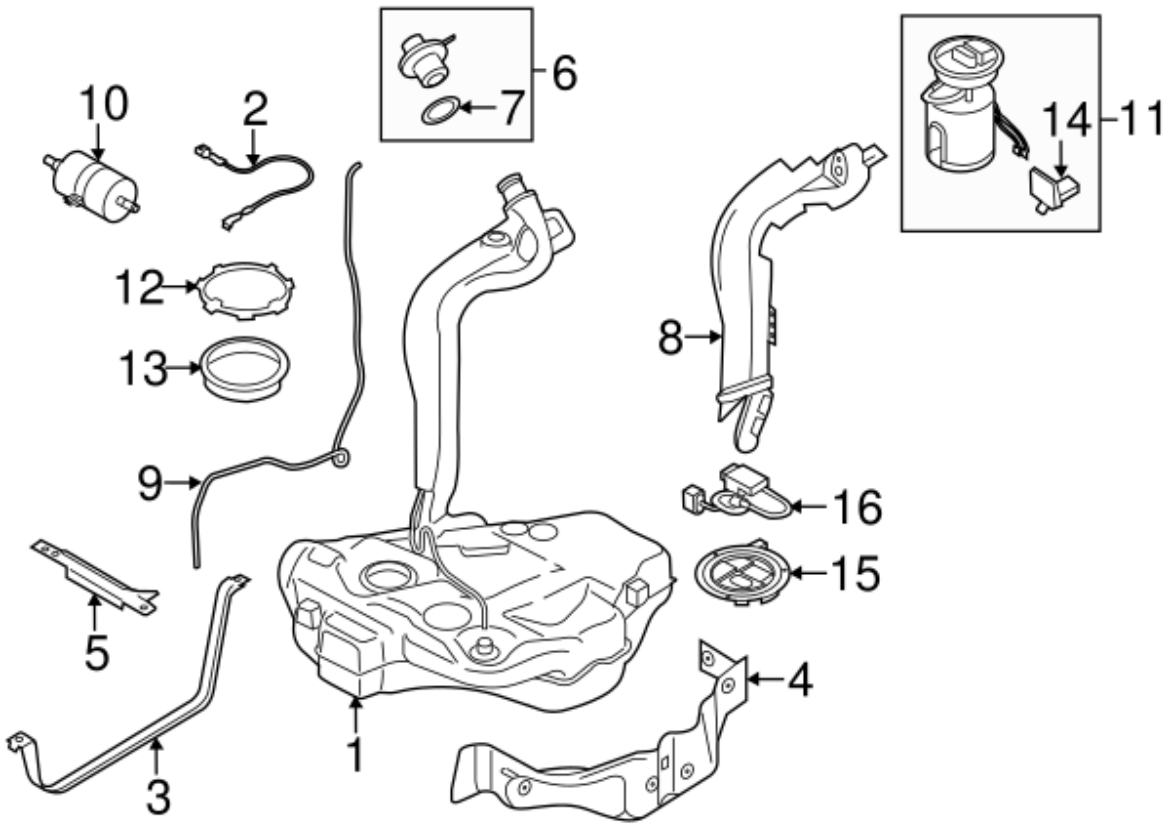


Figure 8

The ’574 patent Accused Instrumentalities comprise a fuel delivery pipe (rail) adapted to deliver fuel to fuel injectors (8) of an automotive vehicle. *See below*.

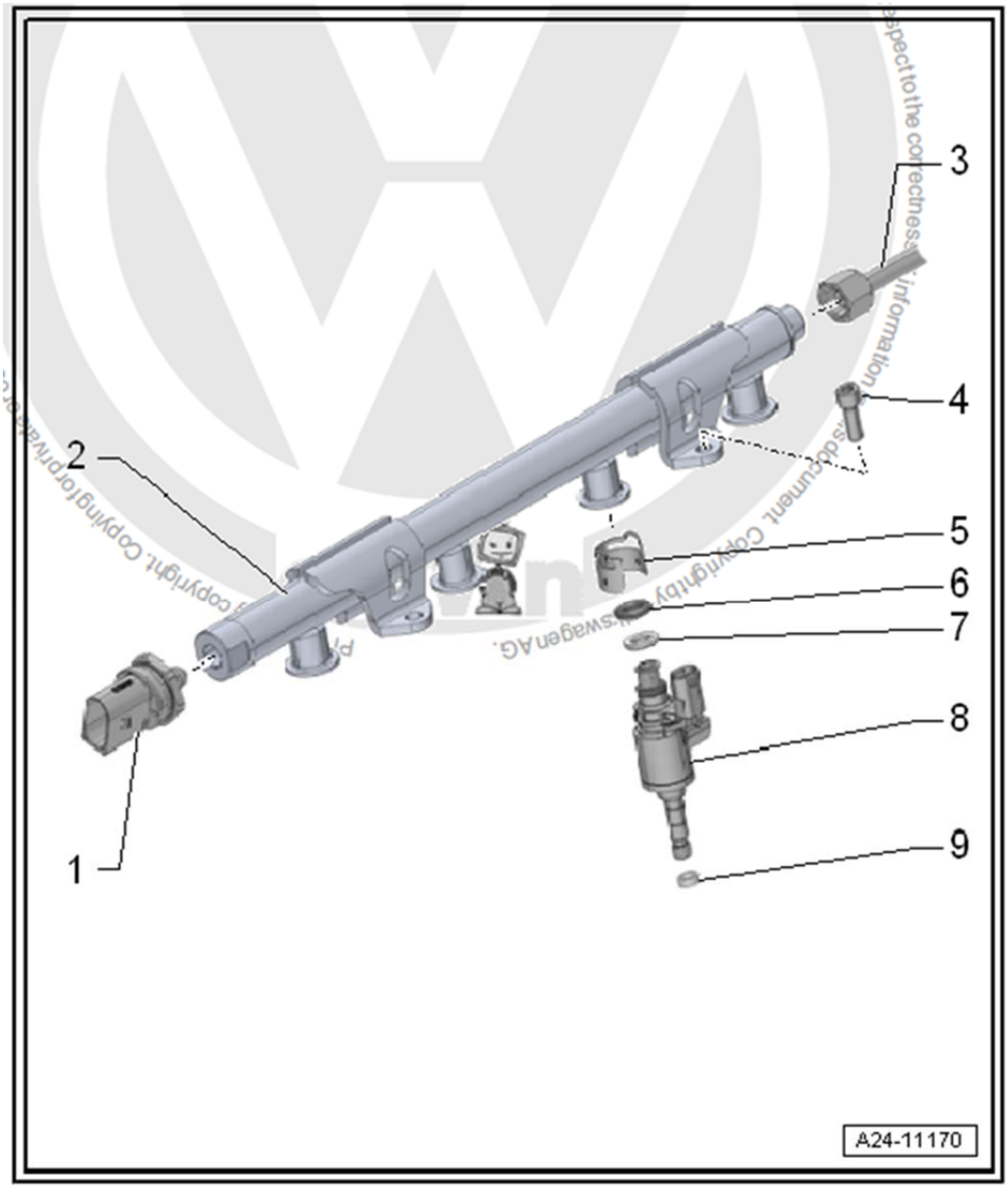


Figure 9

The ’574 patent Accused Instrumentalities comprise a fuel pump (8) adapted to deliver fuel to said fuel rail (2). *See below*.

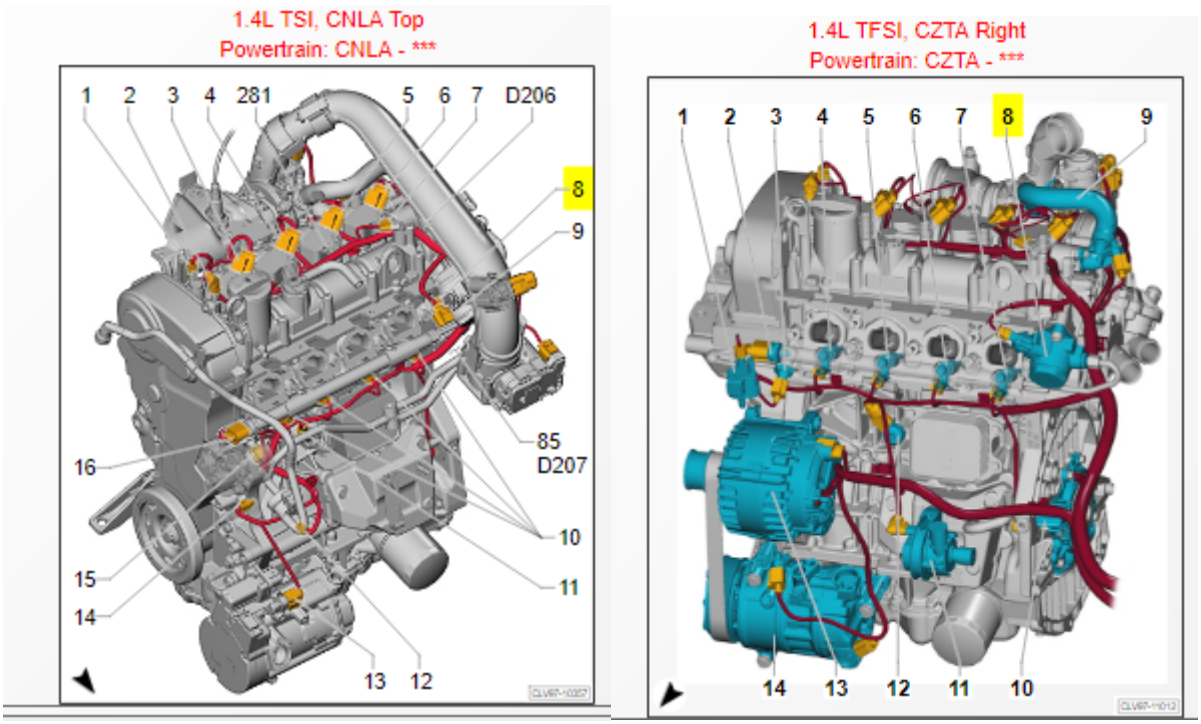
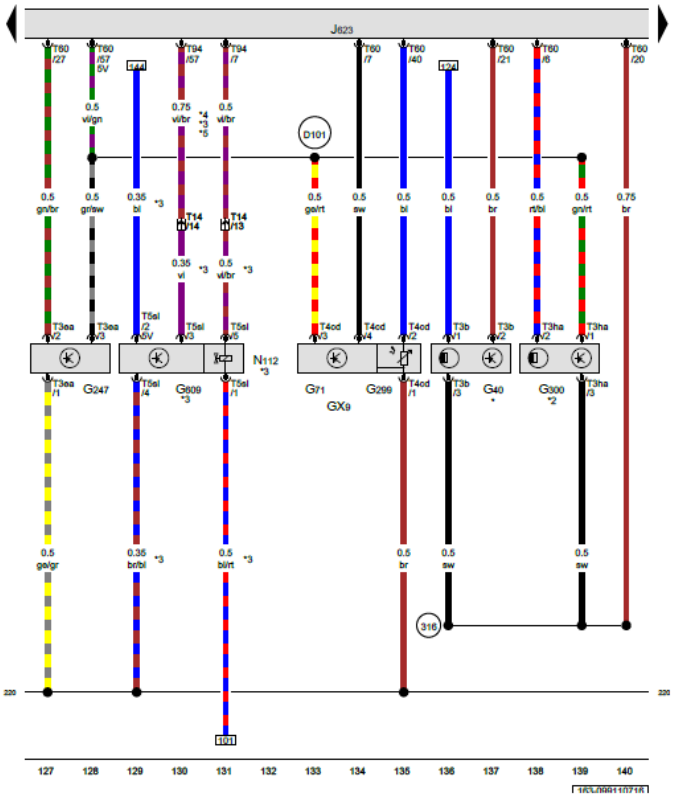


Figure 10

The ’574 patent Accused Instrumentalities comprise a fuel pressure sensor (1; G247) adapted to measure the fuel rail pressure. *See below*.

Jetta Wiring Diagram No. 99 / 11



Intake manifold sensor, Camshaft position sensor, Manifold absolute pressure sensor, Fuel pressure sensor, Intake air temperature sensor 2, Camshaft position sensor 3, Secondary air injection sensor 1, Engine control module, Secondary air injection solenoid valve

GX9	Intake manifold sensor
G40	Camshaft position sensor
G71	Manifold absolute pressure sensor
G247	Fuel pressure sensor
G299	Intake air temperature sensor 2
G300	Camshaft position sensor 3
G609	Secondary air injection sensor 1
J623	Engine control module
N112	Secondary air injection solenoid valve
T3b	3-pin connector
T3ea	3-pin connector
T3ha	3-pin connector
T4cd	4-pin connector
T5sl	5-pin connector
T14	14-pin connector
T60	60-pin connector
T94	94-pin connector
220	Sensor ground connection (in engine wiring harness)
316	Sensor ground connection 2 (in engine wiring harness)
D101	Connection 1 (in engine compartment wiring harness)
*	Camshaft sensor, intake valves
*2	Camshaft sensor, exhaust valves
*3	USA only
*4	The color of the wires depends on vehicle equipment
*5	Diameter depends on equipment

ws	=	white
sw	=	black
ro	=	red
rt	=	red
br	=	brown
gn	=	green
bl	=	blue
gr	=	grey
li	=	lilac
vi	=	lilac
ge	=	yellow
or	=	orange
rs	=	pink

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Figure 11

The ’574 patent Accused Instrumentalities comprise a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors.

Upon information and belief, the ECM (J623) filters the output of the fuel rail pressure sensor (1 below); thereby it also filters out the pulses detected from the fuel rail pressure sensor to thereby filter the output of the fuel rail pressure sensor (1) in such a manner as to filter out pulses due to the opening and closing of the fuel injectors.

Figure 12

The ’574 patent Accused Instrumentalities comprise a fuel pump motor controller (J538). *See below*.

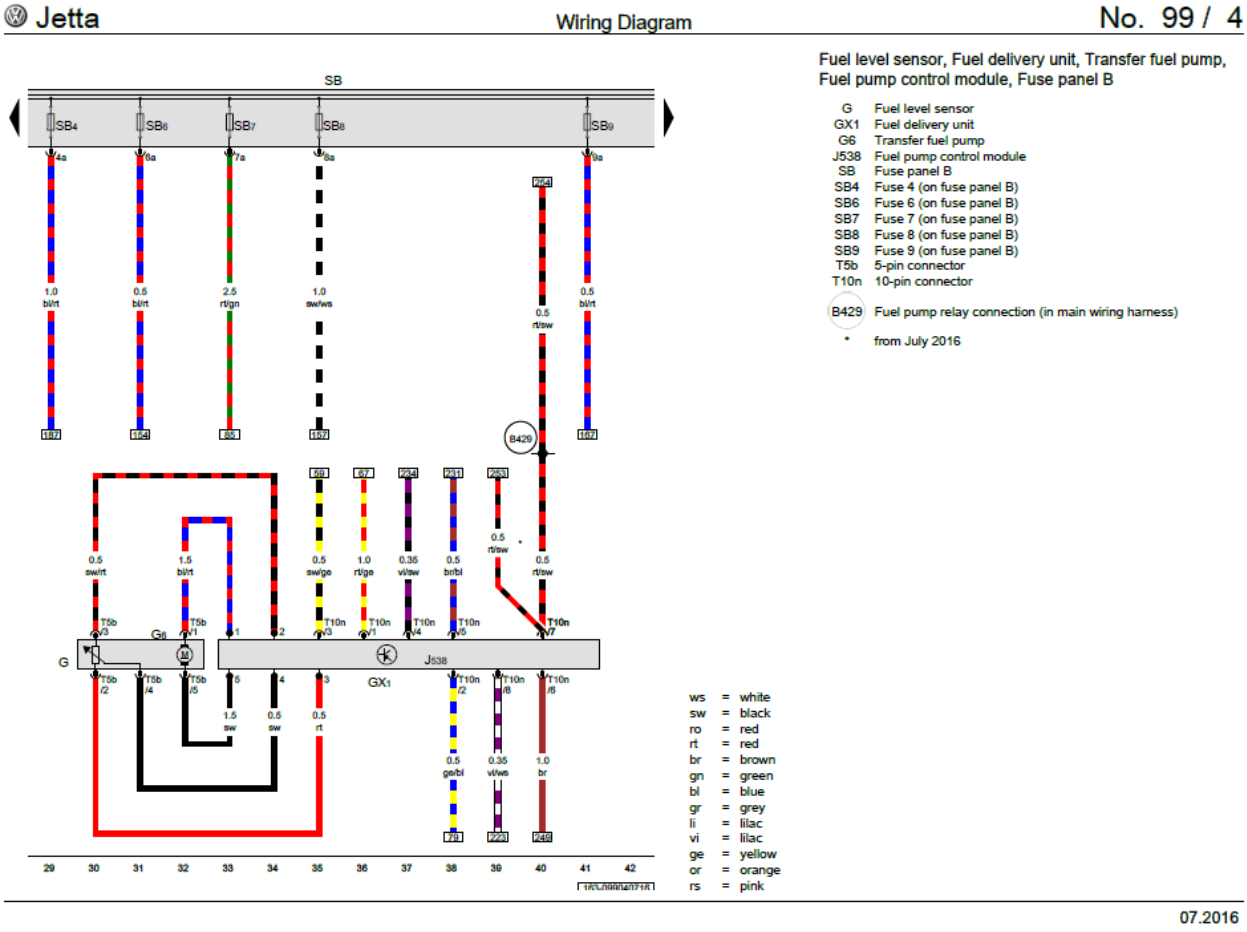
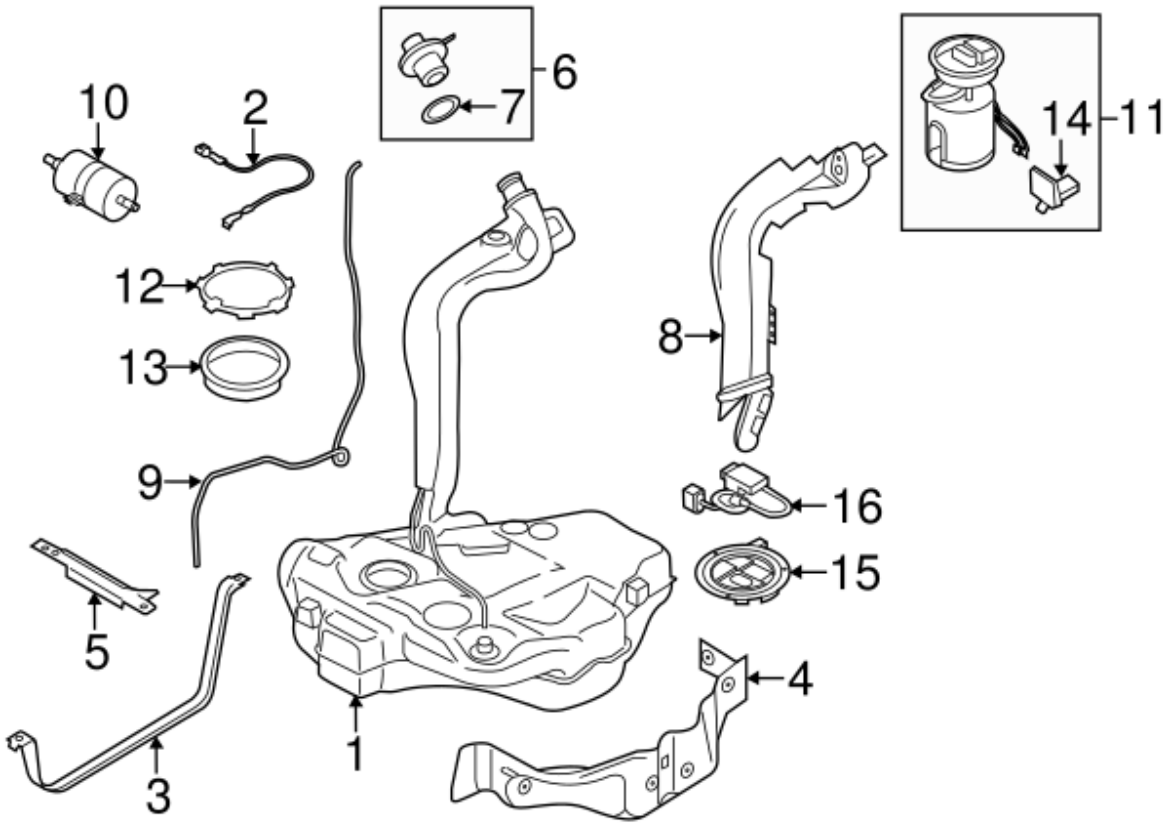


Figure 13

The '574 patent Accused Instrumentalities comprise a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system.

For example, the Engine Control Module (J623) and Fuel pump control module (J538) are feed forward controllers adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the aver fuel flow through said system. *See below*.

For example, the Fuel gauge sending unit (14) shown immediately below, sends fuel data to the ECM, which calculates the estimated average fuel flow through the system.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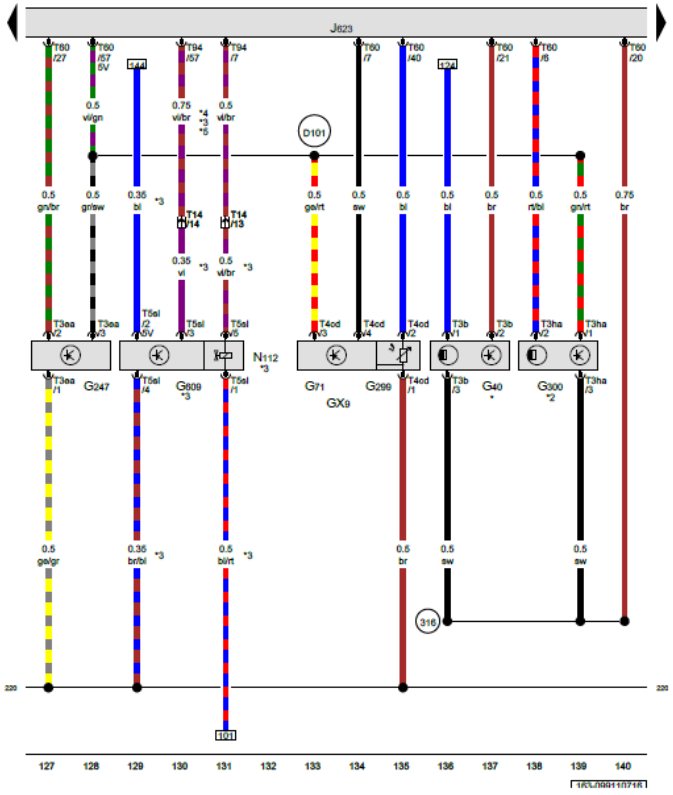

ws = white
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gr = grey
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vi = lilac
ge = yellow
or = orange
rs = pink

Intake manifold sensor, Camshaft position sensor, Manifold absolute pressure sensor, Fuel pressure sensor, Intake air temperature sensor 2, Camshaft position sensor 3, Secondary air injection sensor 1, Engine control module, Secondary air injection solenoid valve

GX9	Intake manifold sensor
G40	Camshaft position sensor
G71	Manifold absolute pressure sensor
G247	Fuel pressure sensor
G299	Intake air temperature sensor 2
G300	Camshaft position sensor 3
G609	Secondary air injection sensor 1
J623	Engine control module
N112	Secondary air injection solenoid valve
T3b	3-pin connector
T3ea	3-pin connector
T3ha	3-pin connector
T4cd	4-pin connector
T5sl	5-pin connector
T14	14-pin connector
T60	60-pin connector
T94	94-pin connector
220	Sensor ground connection (in engine wiring harness)
316	Sensor ground connection 2 (in engine wiring harness)
D101	Connection 1 (in engine compartment wiring harness)
*	Camshaft sensor, intake valves
*2	Camshaft sensor, exhaust valves
*3	USA only
*4	The color of the wires depends on vehicle equipment
*5	Diameter depends on equipment

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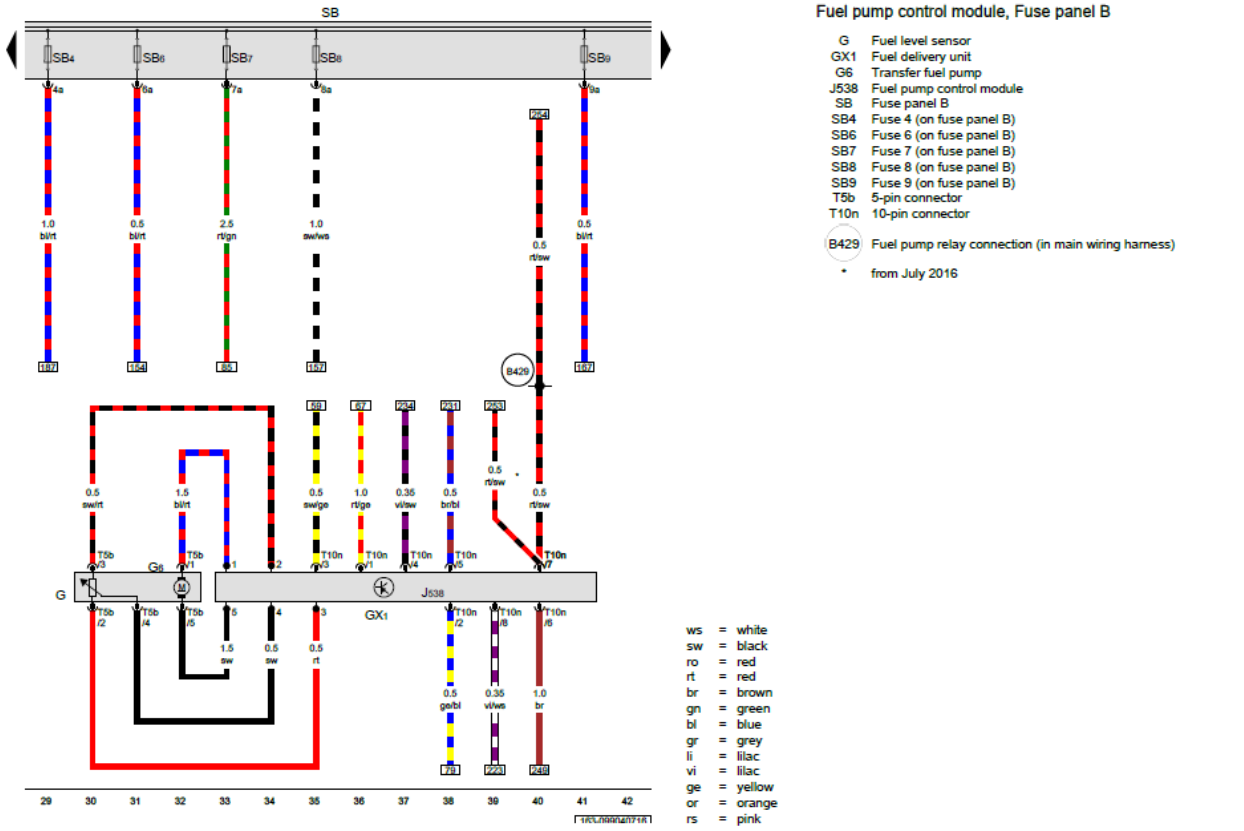


Figure 14

The '574 patent Accused Instrumentalities comprise a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure.

As shown immediately below, the fuel (rail) pressure sensor (1) generates a signal corresponding to the fuel rail pressure. The fuel rail pressure generated by the fuel (rail) pressure sensor is compared to the set point fuel (rail) pressure (calculated and generated by the ECM). When the fuel rail pressure and the set-point fuel pressure differ, an error value is generated based upon the difference.

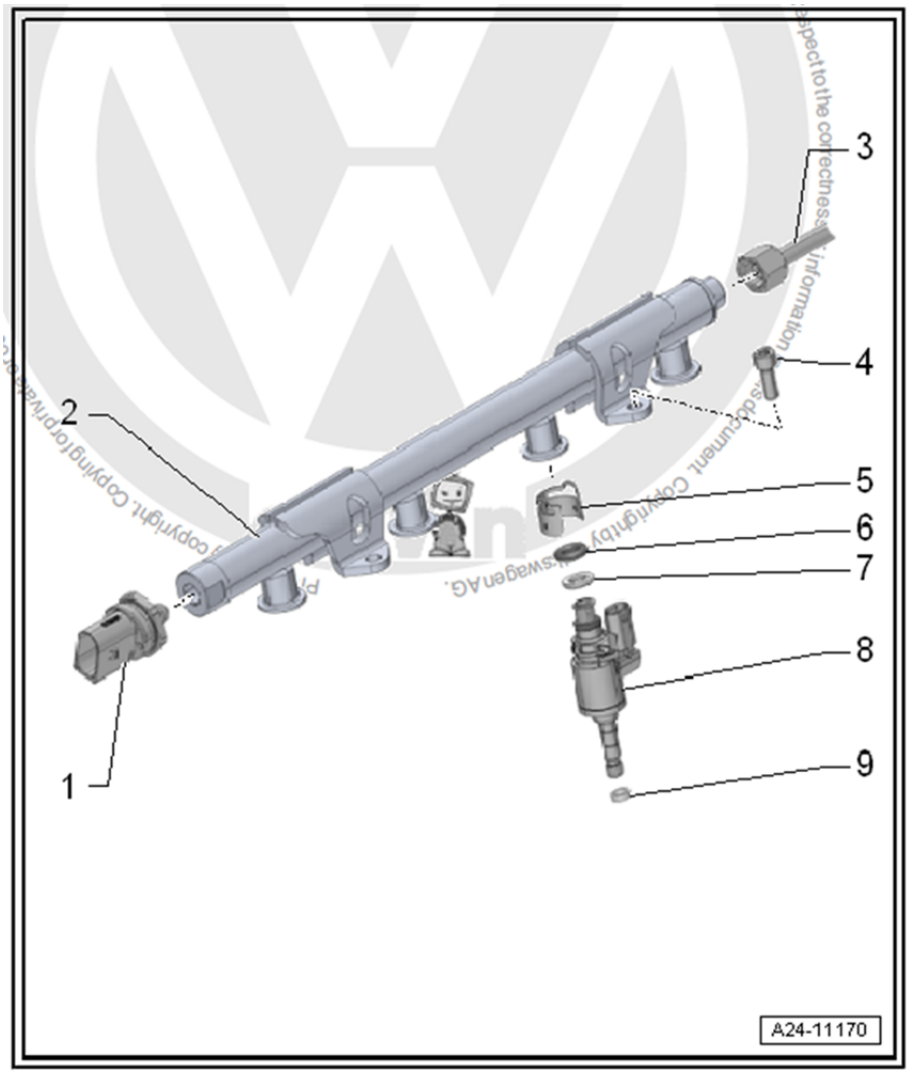


Figure 15

The ’574 patent Accused Instrumentalities comprise a feed back controller adapted to receive the error value and to generate a feed back control signal.

For example, the ECM (J623) is a feed back controller) adapted to receive the error value and generate a feed back control signal.

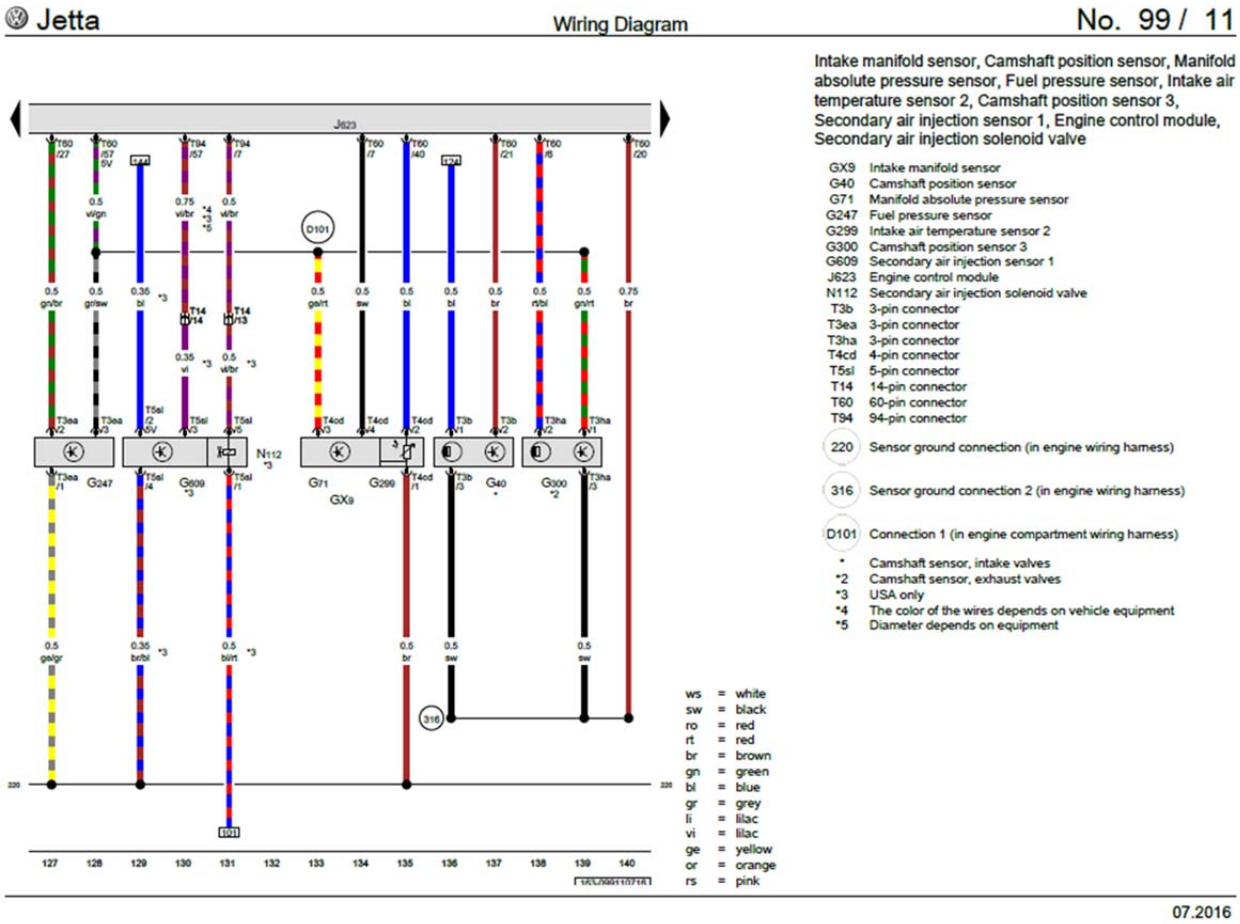
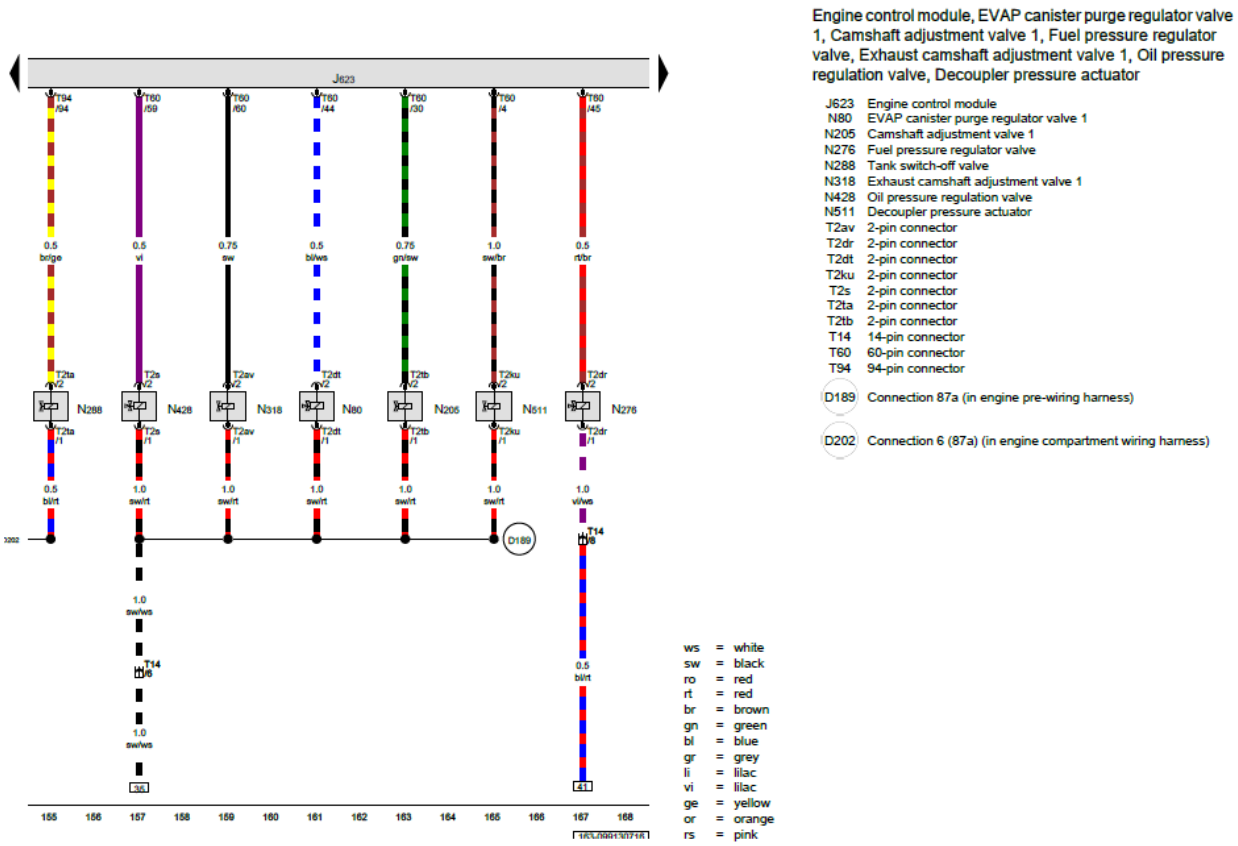


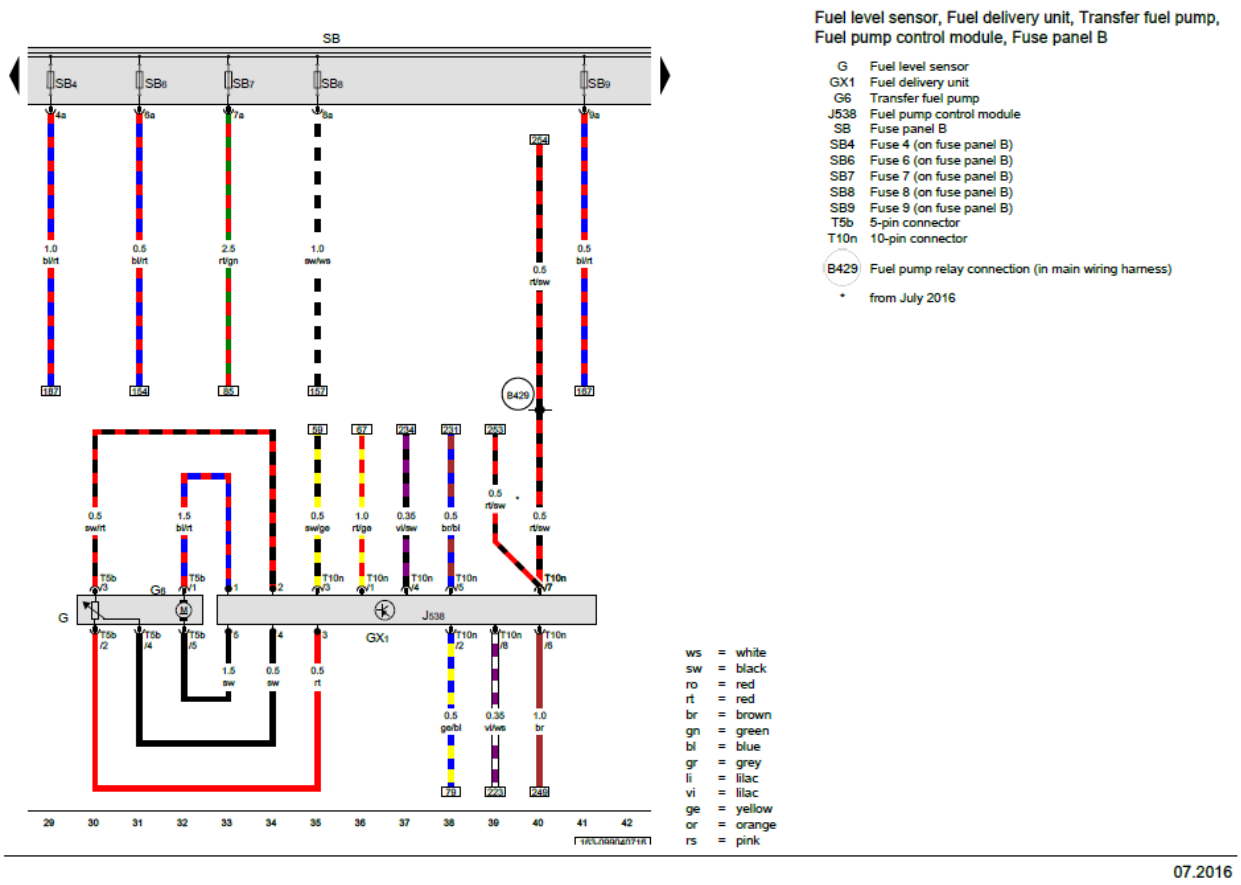
Figure 16

The ’574 patent Accused Instrumentalities comprise a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal.

For example, the ECM (J623) shown below is a feed back controller and a feed forward controller.



For example, as shown below, the fuel pump control module (J538) is a feed forward controller and a feed back controller which modifies the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal.

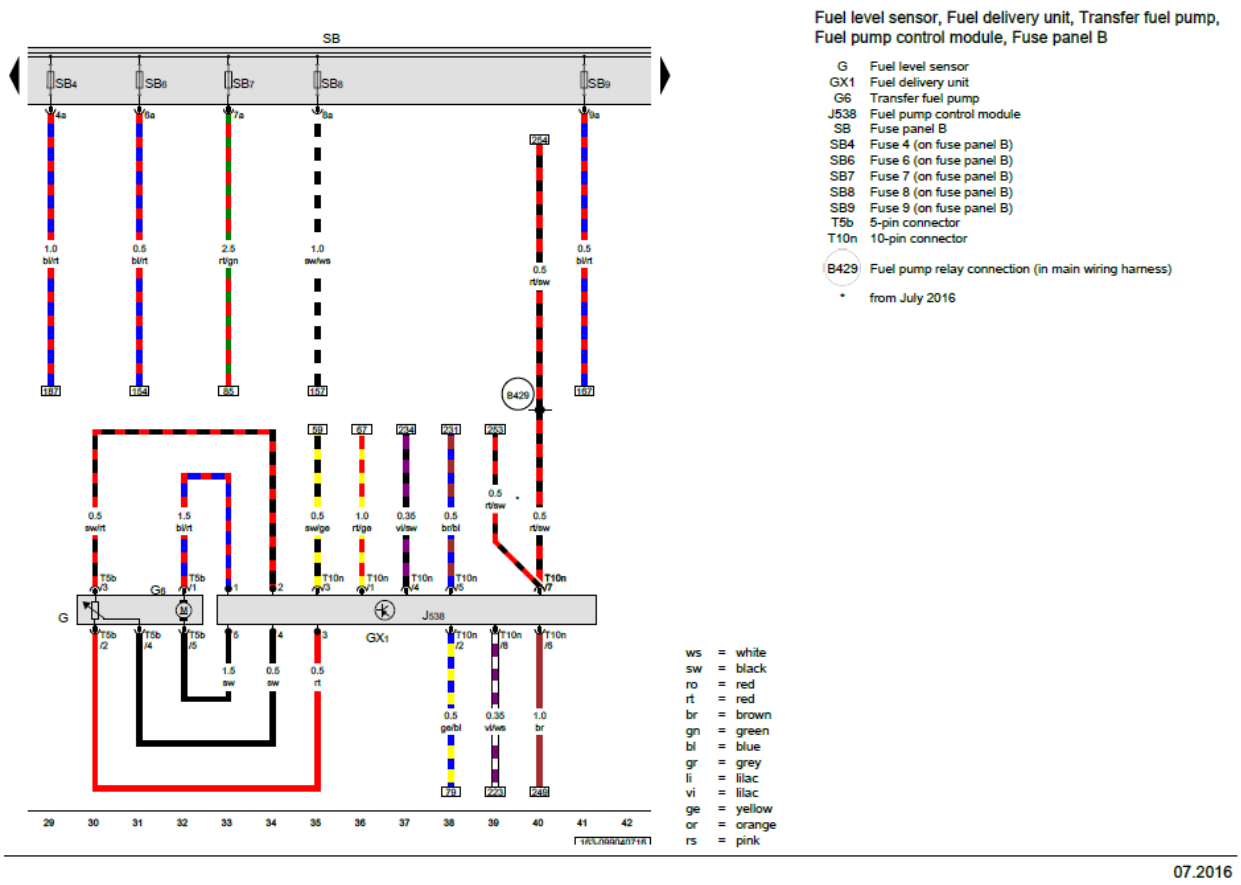


The fuel (rail) pressure sensor (2) installed on the fuel cylinder (fuel rail) and the fuel pressure regulator valve (N276) deliver the modified feed forward control signal based upon the error signal (received from the ECM (J623)) thereby generating a motor controller signal and sending the motor control signal to the fuel pump motor controlled by the fuel pump motor control module (J538). This is accomplished via the fuel delivery unit (GX1) with the fuel pump (G6) with the fuel pump control module (J538).

Figure 17

he ’574 patent Accused Instrumentalities comprise a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

For example, the fuel pump motor controller (J538) (shown below) driver is adapted to receive the motor controller signal (from the ECM (J623) shown above) and to control the speed of said fuel pump based on the motor control signal.



Based upon the totality of the foregoing evidence, and based further upon information and belief, the '574 patent Accused Instrumentalities include a fuel delivery system comprising: a fuel rail adapted to deliver fuel to fuel injectors of an automotive vehicle, a fuel pump adapted to deliver fuel to said fuel rail, a fuel pressure sensor adapted to measure the fuel rail pressure, a low-pass filter adapted to filter the output of said fuel pressure sensor to filter out pulses due to the opening and closing of the fuel injectors, and a fuel pump motor controller having: a feed forward controller adapted to provide a feed forward signal having fuel pump motor control parameters based upon a set-point fuel pressure and the average fuel flow through said system; a first summing junction adapted to compare the fuel rail pressure to the set-point fuel pressure and to generate an error value based upon the difference between the fuel rail pressure and the set-point fuel pressure; a feed back controller adapted to receive the error value and to generate a feed back control signal; a second summing junction adapted to receive the feed back control signal from said feed back controller and the feed forward control signal from the feed forward controller and to modify the fuel pump motor control parameters of the feed forward control signal based upon the feed back control signal to generate a motor controller signal; and a fuel pump motor controller driver adapted to receive the motor controller signal and to control the speed of said fuel pump based upon the motor controller signal.

Figure 18

44. Upon information and belief, the ’574 patent Accused Instrumentalities are used, marketed, provided to, and/or used by or for the Defendants’ partners, clients and/or customers across the country and in this District.

45. The ’574 patent is necessary for the ’574 patent Accused Instrumentalities to perform their assigned function.

46. Upon information and belief, Defendants have induced and continue to induce others to infringe at least claims 1 and 7 of the ’574 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including, but not limited to Defendants’ partners, clients and/or customers whose use of the ’574 patent Accused Instrumentalities constitutes direct infringement of at least one claim of the ’574 patent.

47. In particular, the Defendants’ actions that aid and abet others such as its partners, clients and/or customers to infringe include advertising and distributing the’574 patent Accused Instrumentalities and providing instruction materials, training and services regarding the ’574 patent Accused Instrumentalities.

48. Any party, including Defendants’ partners, clients and/or customers using the ’574 patent Accused Instrumentalities necessarily infringes the ’574 patent because the invention of the ’574 patent is required for the ’574 patent Accused Instrumentalities to work. Defendants advertisements induce others to infringe the ’574 patent. Defendants have knowingly induced infringement since at least receipt of the Previous License Offer Letter prior to August 28, 2017.

49. Upon information and belief, the Defendants are liable as a contributory infringer of the ’574 patent under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States the ’574 patent Accused Instrumentalities that infringe the patented methods, to be

especially made or adapted for use in an infringement of the ’574 patent. Each of the Accused Instrumentality is a material component for use in practicing the ’574 patent and is specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

50. Plaintiff has been harmed by Defendants’ infringing activities.

COUNT II – INFRINGEMENT OF U.S. PATENT NO. 6,609,497

51. The allegations set forth in the foregoing paragraphs 1 through 50 are incorporated into this Second Claim for Relief.

52. On August 26, 2003 the ’497 patent entitled “Method for Determining MBT Timing in an Internal Combustion Engine,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’497 patent is attached as Exhibit 4.

53. Plaintiff is the assignee and owner of the right, title and interest in and to the ’497 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

54. Defendants were made aware of the ’574 patent prior to August 28, 2017 when it received the Previous License Offer Letter, and as late as February 19, 2019 when MMT filed its complaint in the Michigan Litigation.

55. Upon information and belief, Defendants have directly infringed at least claim 1 of the ’497 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015- 2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 engines (“the ’497 patent Accused Instrumentalities”).

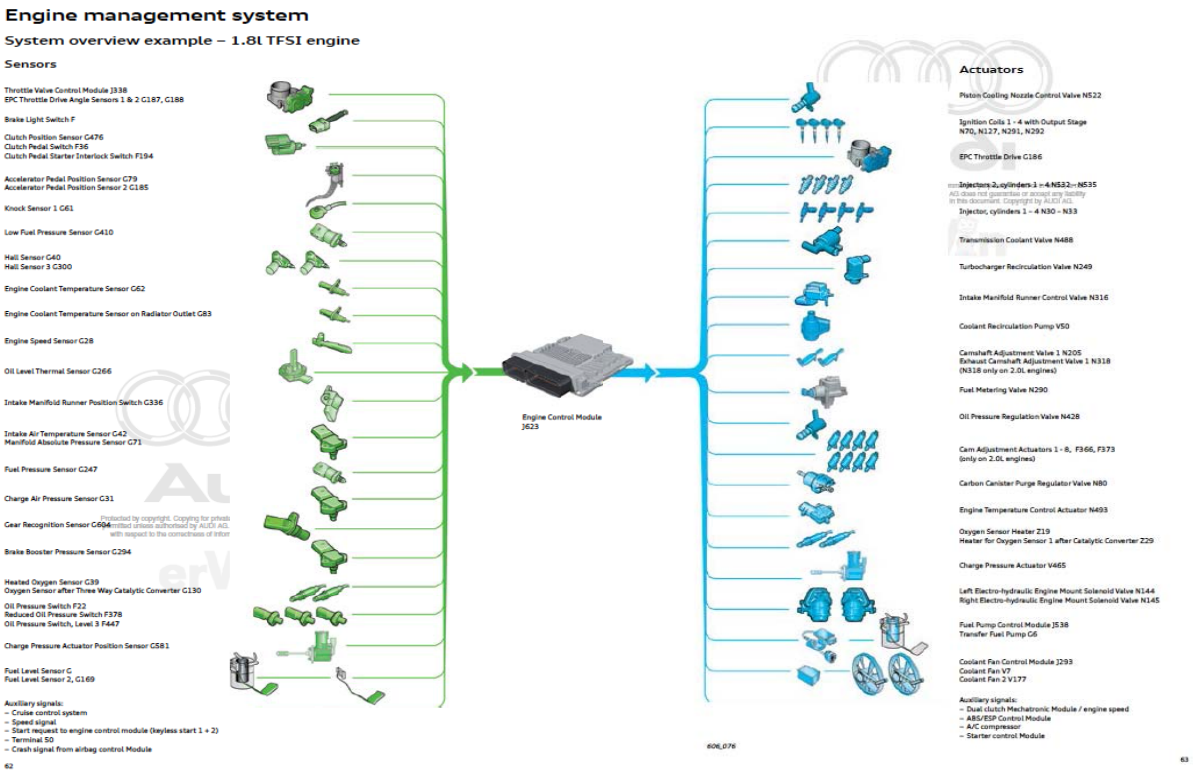
56. In particular, claim 1 of the ’497 patent recites a method of controlling an internal combustion engine, said engine having at least one cylinder, said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at at least two discrete times during a combustion cycle; calculating a net combustion pressure change in said at least one cylinder based on said measured combustion pressures; calculating the second derivative of said net combustion pressure change; calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change; and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.

57. On information and belief, the ’497 patent Accused Instrumentalities infringe claim 1 of the ’497 patent. The ’497 patent Accused Instrumentalities practice a method of controlling an internal combustion engine (*Figure 19*), said engine having at least one cylinder (*Figure 19*), said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at least two discrete times during a combustion cycle (*Figure 20*); calculating a net combustion pressure change in said at least one cylinder based on said measured combustion pressures (*Figure 21*) calculating the second derivative of said net combustion pressure change *(Figure 22*); calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change (*Figure 23*); and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing (*Figure 24*).

eSelf-Study Program 920243

The Audi 1.8L and 2.0L Third Generation EA888 Engines

Audi Academy



As shown above, the Engine Management System including the Engine Control Module (ECM; J623) controls the Audi 1.8L and 2.0L Third Generation EA888 Engines (internal combustion engine). The '497 patent Accused Instrumentalities comprise the Audi 1.8L and 2.0L Third Generation EA888 Engines.

Figure 19

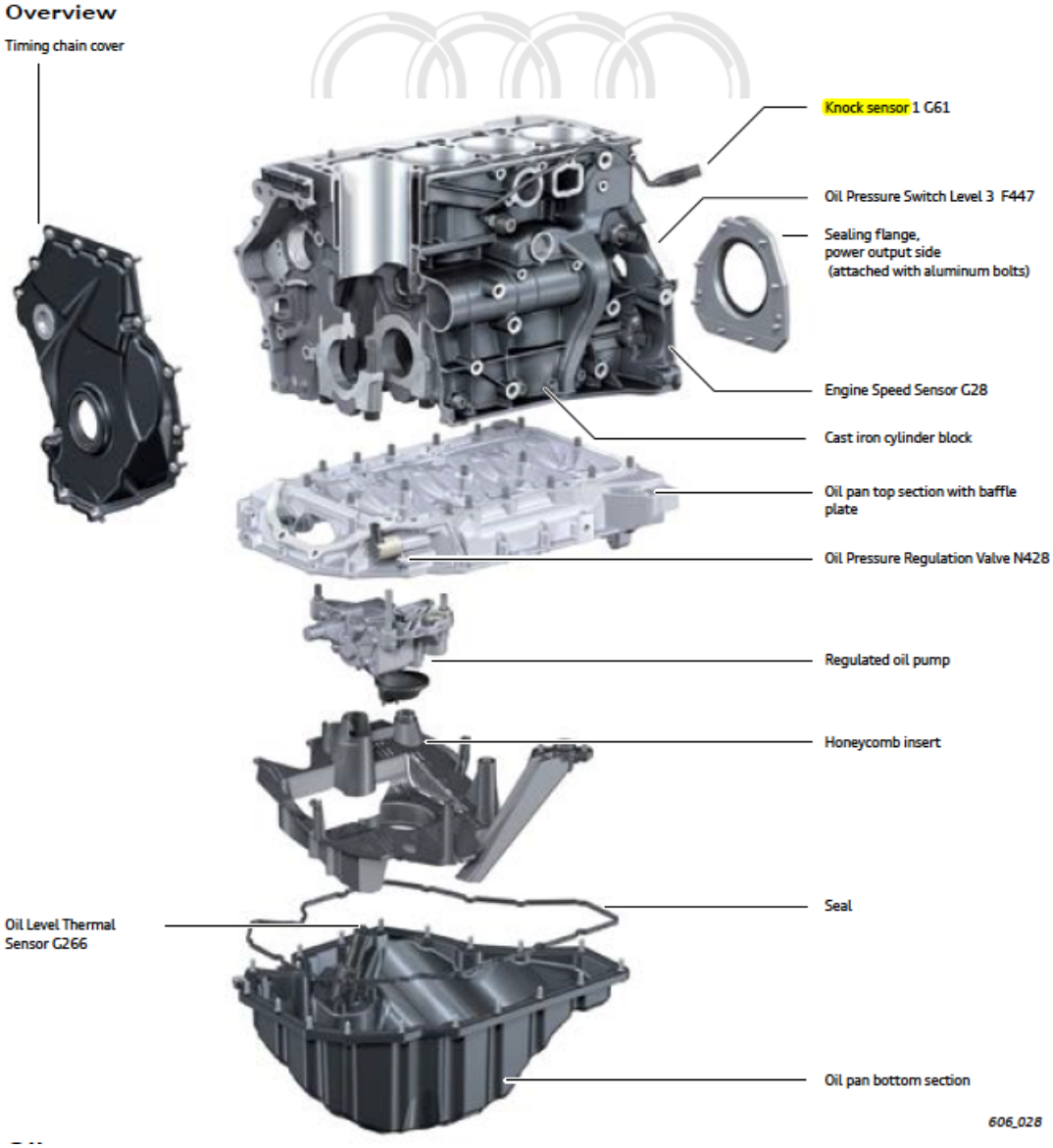
The '497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises measuring the combustion pressure in said at least one cylinder at least at two discrete times during a combustion cycle. As shown below, DTC P03AF, Cylinder 3 Pressure Too High, utilizes the Knock Control Function to detect Knock Activity (cylinder pressure) at two discrete times during a combustion cycle; it detects (measures) knock in both the main knock window and the pre-knock window (two discrete times).

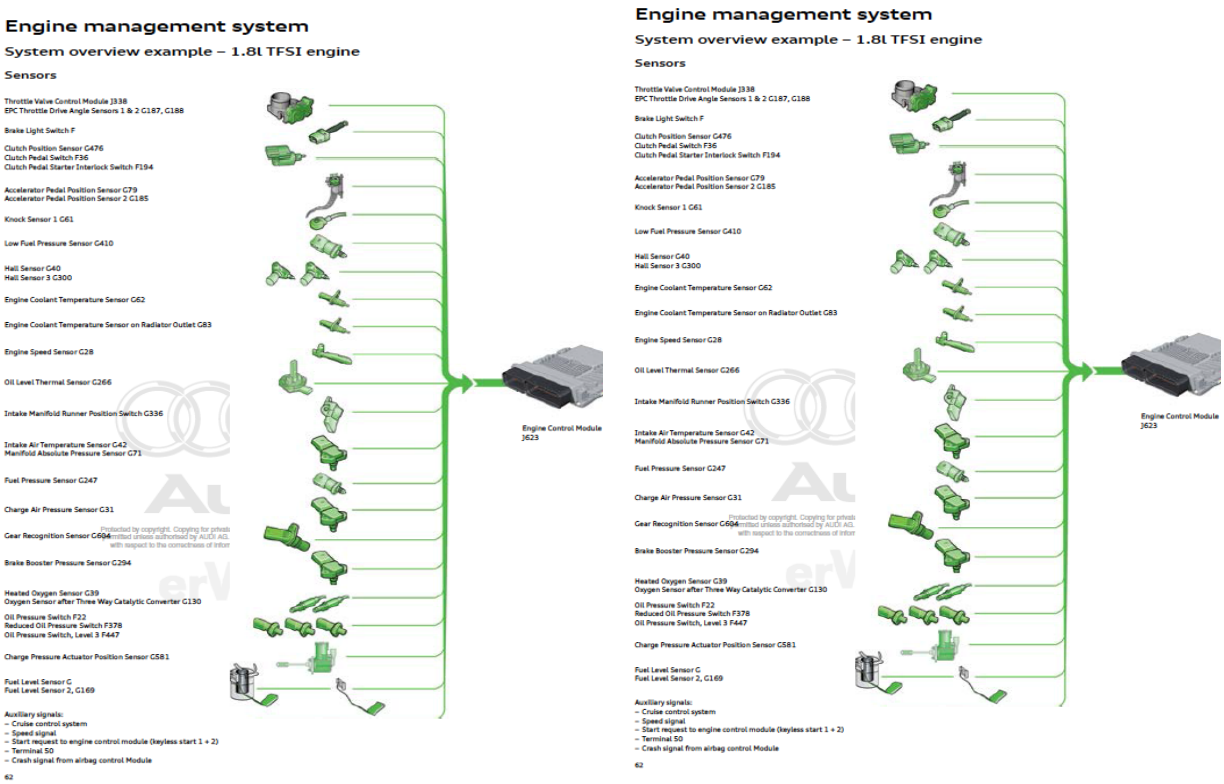
As shown below, the engine control system comprises the knock sensor. The PCM calculates cylinder combustion pressure as derived from the knock sensor input.

Engine Management

- Electronic engine management system with EPC
- Combined direct and port injection systems*
- Adaptive O_2 sensor control
- Mapped ignition with high voltage ignition coils
- Cylinder-selective adaptive knock control

Overview





eSelf-Study Program 920243

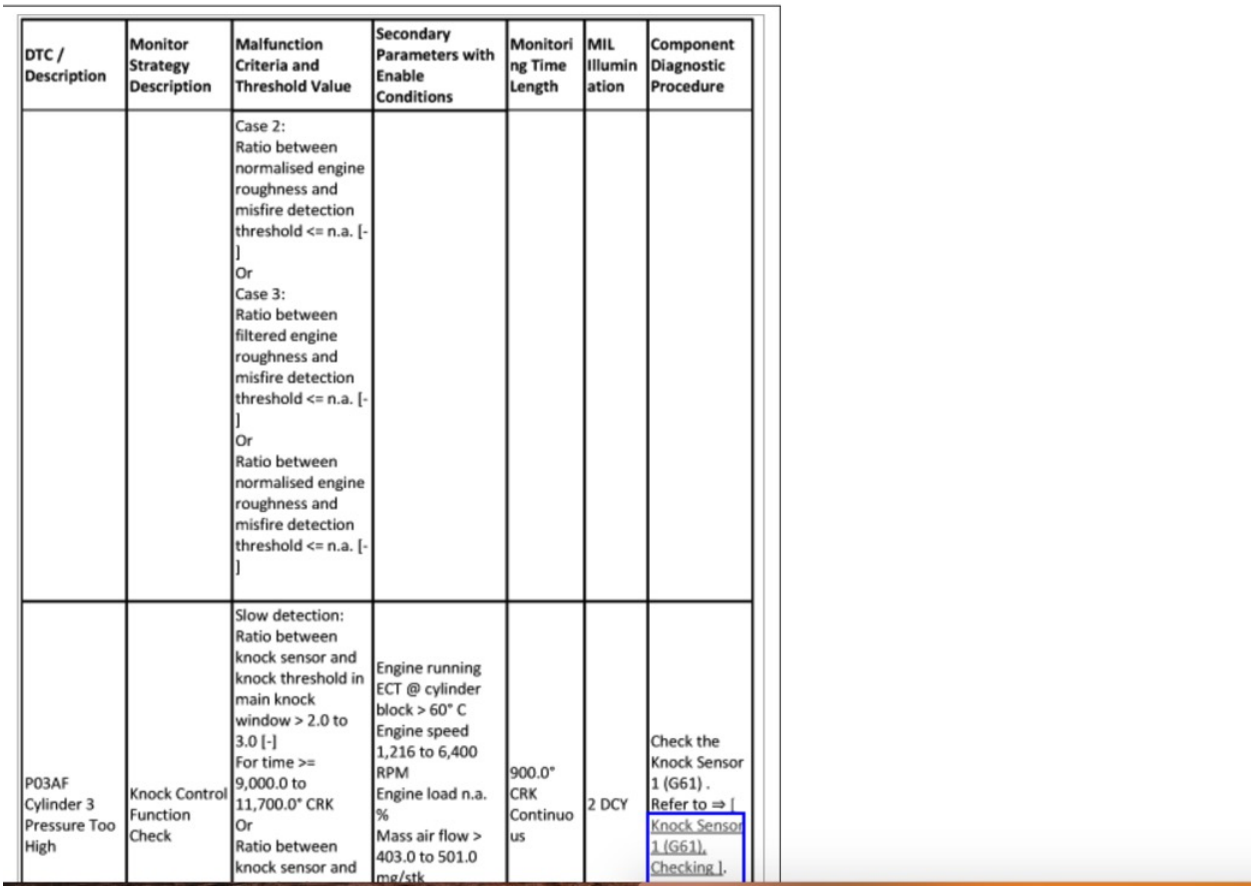
As shown below, DTC P03AF corresponds to a condition where Cylinder 3 pressure is too high (implying that at least combustion pressure in Cylinder 3 is measured). The PCM calculates combustion pressure derived from the knock sensor input.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

Zoom Sized for Print

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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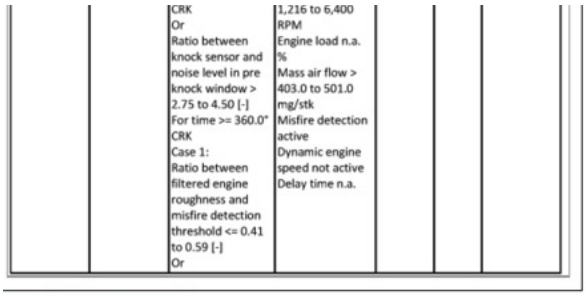
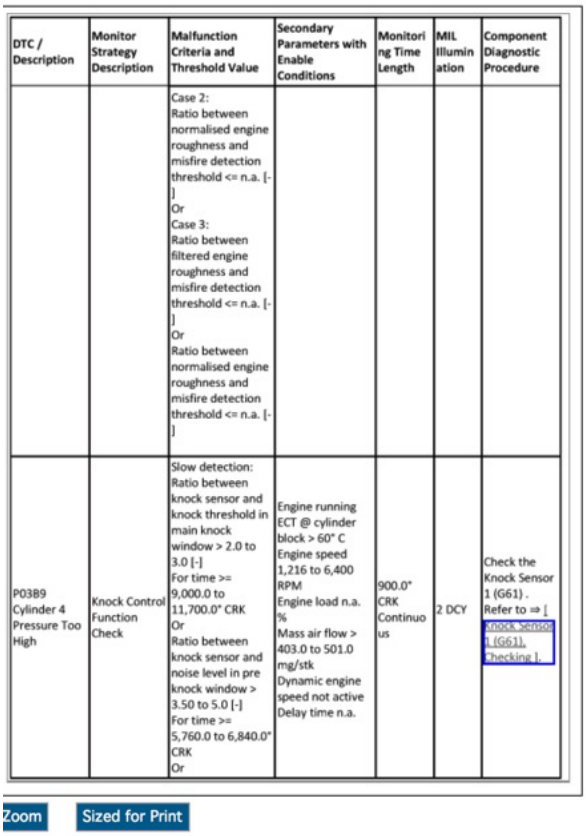


		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

Zoom Sized for Print



DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

Zoom Sized for Print

ALLDATA

The ECM/PCM detects cylinder pressure as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the cylinder pressure is measured at least at two discrete times during a combustion cycle.

Figure 20

As shown below, DTC P03AF corresponds to a condition where Cylinder 3 pressure is too high (implying that at least combustion pressure in Cylinder 3 is measured). The PCM calculates combustion pressure derived from the knock sensor input. Additionally, the PCM calculates the cylinder pressure (combustion pressure) at two discrete times in both the main knock window

and the pre-knock window, the net pressure (difference between second and first discrete combustion pressure measurements) is calculated.

2014 Volkswagen Passat Sedan (A32) L4-1.8L Turbo (CPKA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P03AF » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

Zoom Sized for Print

ALLDATA

The ECM/PCM detects cylinder pressure as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a net combustion pressure change based on measured combustion pressures in service of achieving maximum brake torque (MBT).

Figure 21

The ’497 patent Accused Instrumentalities practice a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises calculating the second derivative of said net combustion pressure change.

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

Zoom Sized for Print

ALLDATA

The ECM/PCM has the ability to detect cylinder pressure at two discrete times as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a second derivative of said net combustion pressure change.

Figure 22

The ’497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change.

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

P03AF Cylinder 3 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

Zoom Sized for Print

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 12,960.0 to 16,740.0° CRK Or Torque limitation factor < 0.90 [-]				
		Fast detection: Ratio between knock sensor and knock threshold in main knock window > 1.50 to 2.50 [-] For time >= 540.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

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		CRK Or Ratio between knock sensor and noise level in pre knock window > 2.75 to 4.50 [-] For time >= 360.0° CRK Case 1: Ratio between filtered engine roughness and misfire detection threshold <= 0.41 to 0.59 [-] Or	1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Misfire detection active Dynamic engine speed not active Delay time n.a.			

Zoom Sized for Print

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		Case 2: Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-] Or Case 3: Ratio between filtered engine roughness and misfire detection threshold <= n.a. [-] Or Ratio between normalised engine roughness and misfire detection threshold <= n.a. [-]				
P03B9 Cylinder 4 Pressure Too High	Knock Control Function Check	Slow detection: Ratio between knock sensor and knock threshold in main knock window > 2.0 to 3.0 [-] For time >= 9,000.0 to 11,700.0° CRK Or Ratio between knock sensor and noise level in pre knock window > 3.50 to 5.0 [-] For time >= 5,760.0 to 6,840.0° CRK Or	Engine running ECT @ cylinder block > 60° C Engine speed 1,216 to 6,400 RPM Engine load n.a. % Mass air flow > 403.0 to 501.0 mg/stk Dynamic engine speed not active Delay time n.a.	900.0° CRK Continuous	2 DCY	Check the Knock Sensor 1 (G61) . Refer to ⇒ [Knock Sensor 1 (G61), Checking].

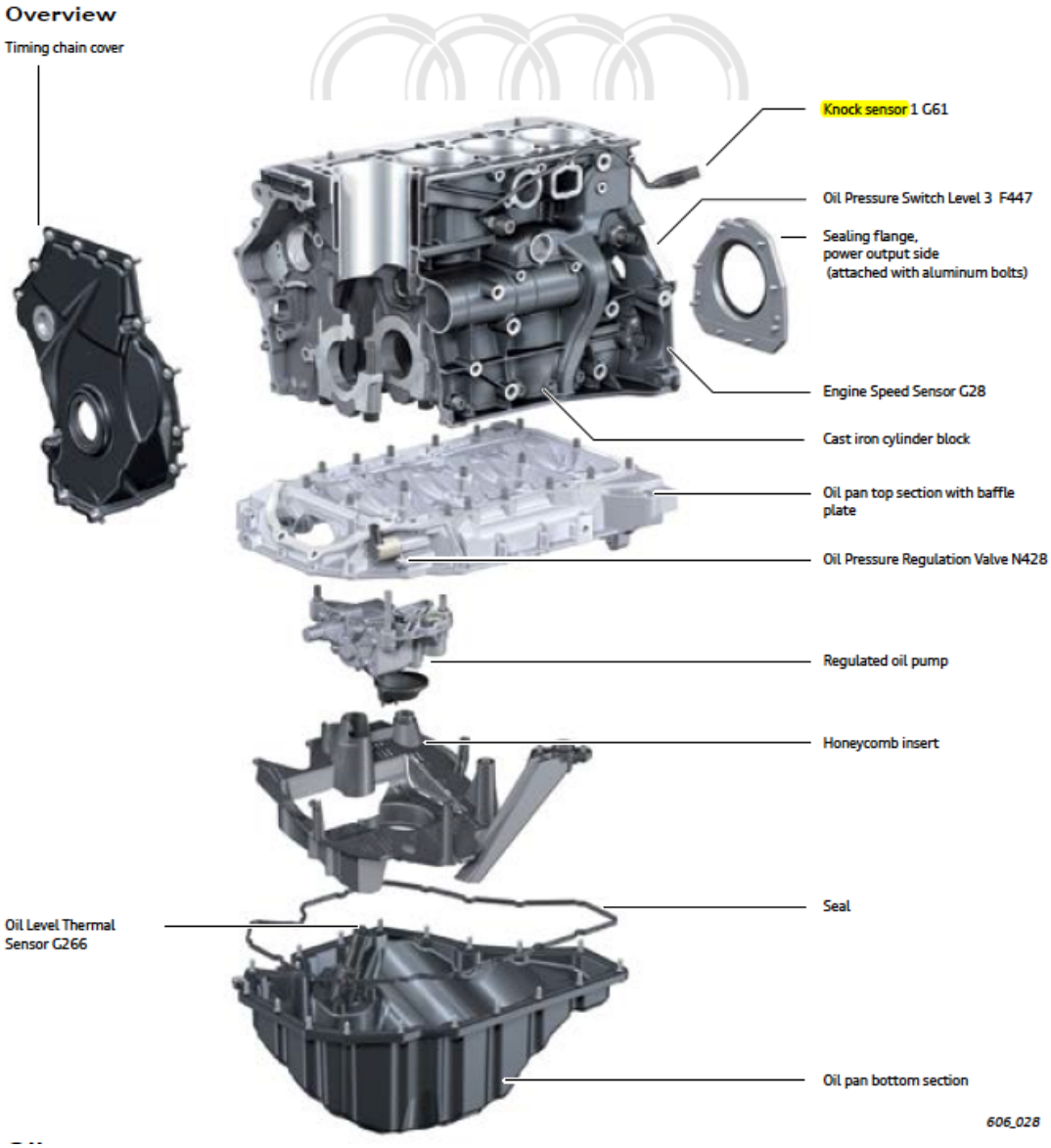
Zoom Sized for Print

ALLDATA

The ECM/PCM has the ability to detect cylinder pressure at two discrete times as demonstrated by the Diagnostic Trouble Code (DTC) shown above. Based upon information and belief, the ECM/PCM calculates a maximum acceleration point of a net combustion pressure change from said second derivative of said net combustion pressure change.

Figure 23

The ’497 patent Accused Instrumentalities comprise a method of controlling an internal combustion engine, said engine having at least one cylinder, wherein said method comprises varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.



The ECM has the ability to retard ignition timing (vary spark timing) based on knock detection as this has been the state of the art for quite some time. Based upon information and belief, the ECM varies the spark timing of the engine until the maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing.

Figure 24

Based upon the totality of the foregoing evidence, and based further upon information and belief, the ’497 patent Accused Instrumentalities practice “a method of controlling an internal combustion engine, said engine having at least one cylinder, said method comprising the steps of: measuring the combustion pressure in said at least one cylinder at at least two discrete times during a combustion cycle; calculating a net combustion pressure change in said at least one

cylinder based on said measured combustion pressures; calculating the second derivative of said net combustion pressure change; calculating the maximum acceleration point of said net combustion pressure change from said second derivative of said net combustion pressure change; and varying the spark timing of said engine until said maximum acceleration point is aligned with top dead center to achieve maximum braking torque spark timing."

58. Upon information and belief, the '497 patent Accused Instrumentalities are used, marketed, provided to, and/or used by or for the Defendants' partners, clients and/or customers across the country and in this District.

59. The '497 patent is necessary for the '497 patent Accused Instrumentalities to perform their assigned function.

60. Upon information and belief, Defendants have induced and continue to induce others to infringe at least claims 1 of the '497 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including, but not limited to Defendants' partners, clients and/or customers whose use of the '497 patent Accused Instrumentalities constitutes direct infringement of at least one claim of the '497 patent.

61. In particular, the Defendants' actions that aid and abet others such as its partners, clients and/or customers to infringe include advertising and distributing the '497 patent Accused Instrumentalities and providing instruction materials, training and services regarding the '497 patent Accused Instrumentalities.

62. Any party, including Defendants' partners, clients and/or customers using the '497 patent Accused Instrumentalities necessarily infringes the '497 patent because the invention of the '497 patent is required for the '497 patent Accused Instrumentalities to work. Defendants advertisements induce others to infringe the '497 patent. Defendants have knowingly induced infringement since at least receipt of the Previous License Offer Letter prior to August 28, 2017.

63. Upon information and belief, the Defendants are liable as a contributory infringer of the ’497 patent under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States the ’497 patent Accused Instrumentalities that infringe the patented methods, to be especially made or adapted for use in an infringement of the ’497 patent. Each of the Accused Instrumentality is a material component for use in practicing the ’497 patent and is specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

64. Plaintiff has been harmed by Defendants’ infringing activities.

COUNT III – INFRINGEMENT OF U.S. PATENT NO. 6,557,540

65. The allegations set forth in the foregoing paragraphs 1 through 64 are incorporated into this Third Claim for Relief.

66. On May 6, 2003 the ’540 patent entitled “Method of Calculating a Valve Timing Command for an Engine,” was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the ’540 patent is attached as Exhibit 5.

67. Michigan Motor is the assignee and owner of the right, title and interests in and to the ’540 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

68. Defendants were made aware of the ’574 patent prior to August 28, 2017 when it received the Previous License Offer Letter, and as late as February 19, 2019 when MMT filed its complaint in the Michigan Litigation.

69. Upon information and belief, Defendants have directly infringed at least claims 1, 7, 11, and 14 of the ’540 patent by making, using, selling, importing and/or providing and causing to be used the 2011-2015 Volkswagen Jetta (2.0L) direct injection engine (the “’540 patent Accused Instrumentalities”).

70. In particular, claim 1 of the ’540 patent recites a method for calculating a valve timing command for an engine of a vehicle, comprising: obtaining an engine performance command; receiving an environmental conditions signal; determining a valve feedforward term based on the engine performance command and the environmental conditions signal; receiving an engine performance feedback; calculating a valve feedback term based on the engine performance command and the engine performance feedback; and calculating a valve timing command based on the valve feedforward term and the valve feedback term.

71. On information and belief, the ’540 patent Accused Instrumentalities infringe claim 1 of the ’540 patent. The ’540 patent Accused Instrumentalities practice a method for calculating a valve timing command for an engine of a vehicle, comprising (Figure 25): obtaining an engine performance command (Figure 26); receiving an environmental conditions signal (Figure 27); determining a valve feedforward term based on the engine performance command and the environmental conditions signal (Figure 28); receiving an engine performance feedback (Figure 29); calculating a valve feedback term based on the engine performance command and the engine performance feedback (Figure 30); and calculating a valve timing command based on the valve feedforward term and the valve feedback term (Figure 31).

As depicted below the Engine Control Module (ECM) calculates valve timing for an engine of a vehicle.

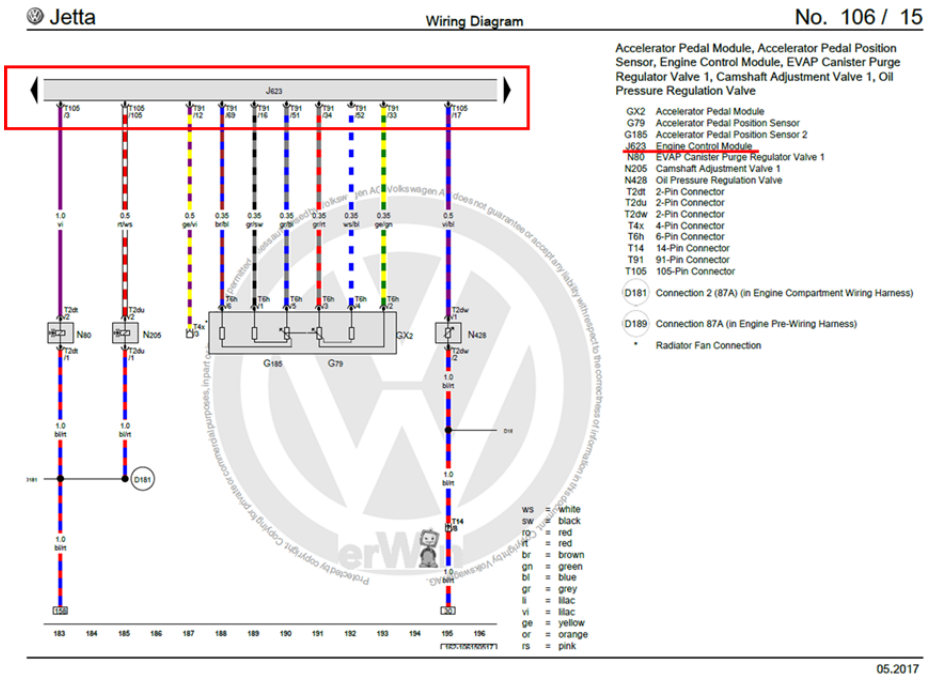
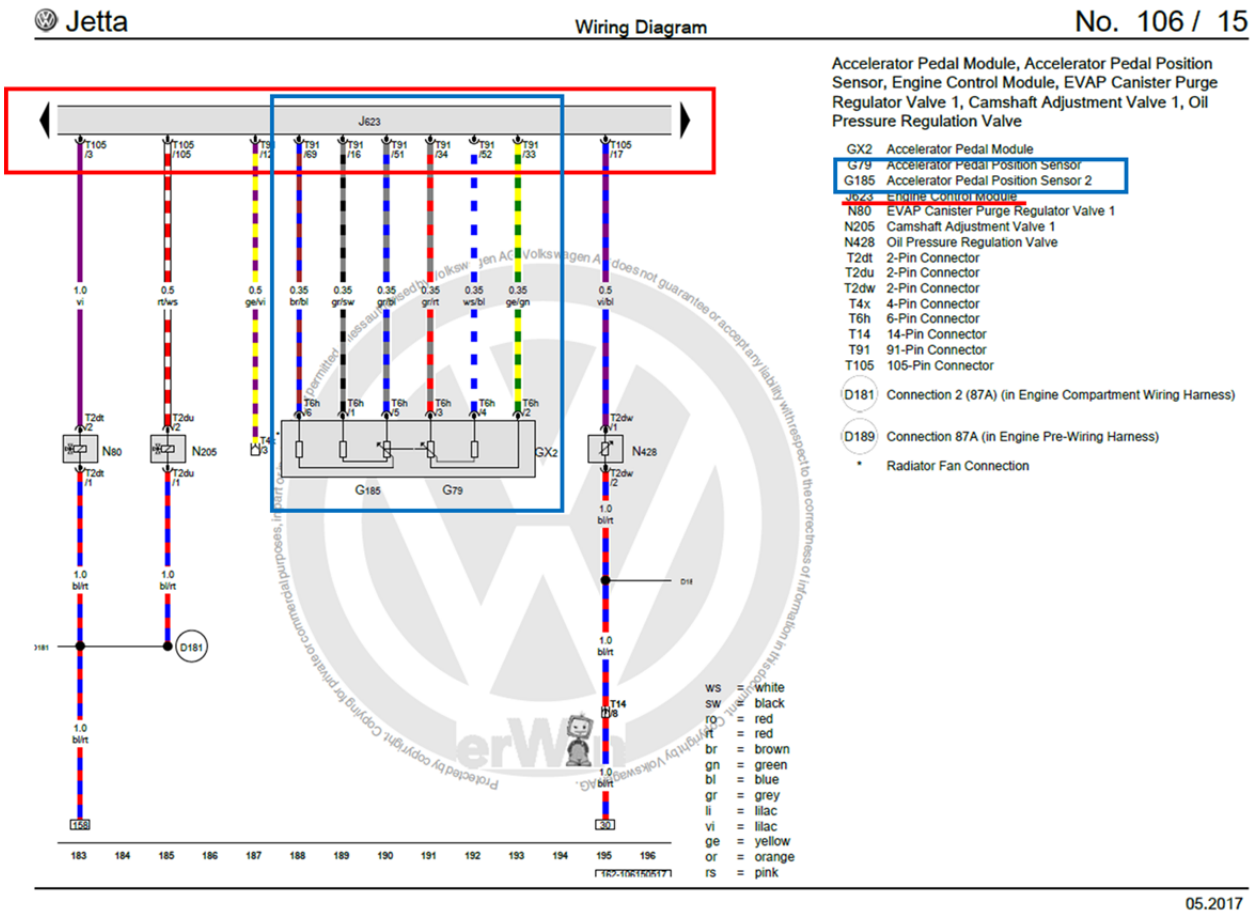
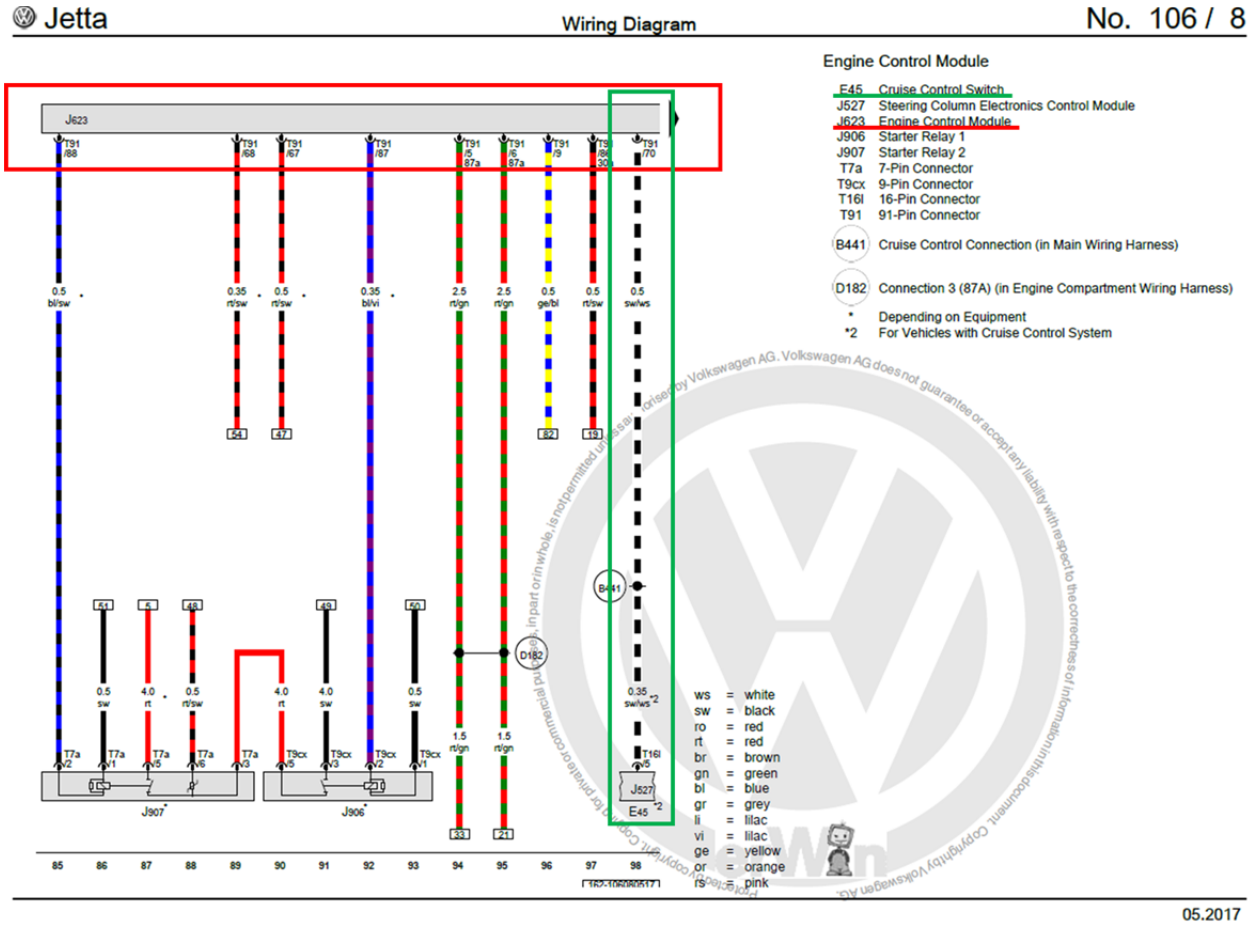


Figure 25

For example, as shown below, the Accelerator Pedal Position Sensor provides a signal to the ECM for the performance commands from the operator.



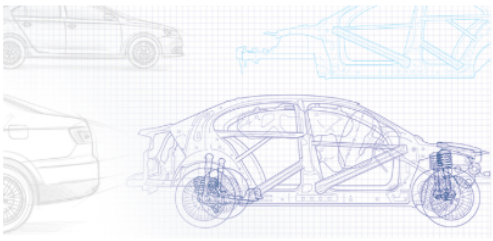
For example, as shown below, the Cruise Control Switch provides a signal to the ECM for the performance commands based on the cruise control settings.



For example, as shown below, an engine performance command (traction control signal and acceleration signal) is obtained by the ECM.

How does Volkswagen Electronic Stability Control work?

During the 2009 model year Volkswagen made the decision to add Electronic Stability Control as a safety feature on its entire lineup, a full three years before it became required on all new vehicles for 2012. You won't find a new vehicle without this feature in much the same way you can expect the safety features to always include airbags, but what is it and **how does Volkswagen Electronic Stability Control work**?



Many people are already aware of the anti-lock brake feature, which prevents wheels from locking up when braking, and traction control, which is meant to prevent wheels from spinning. Electronic stability control (ESC) uses the same hardware as these other safety features, but also uses a yaw rate, steering angle and acceleration sensors to detect whether the vehicle is headed in the direction the driver is attempting to make it go in. Whether the road conditions are slipper or you're driving at high speeds, when the ESC system detects a slip, brakes are automatically applied to just the wheels that aren't going in the right direction.

Read More: VW Technology & Features

https://www.newcenturyvw.com/blog/how-does-volkswagen-electronic-stability-control-work/

For example, as shown below, the electronic stability program (ESP) sensor unit (G419), and ABS control module and wheel speed sensors obtain engine performance commands.

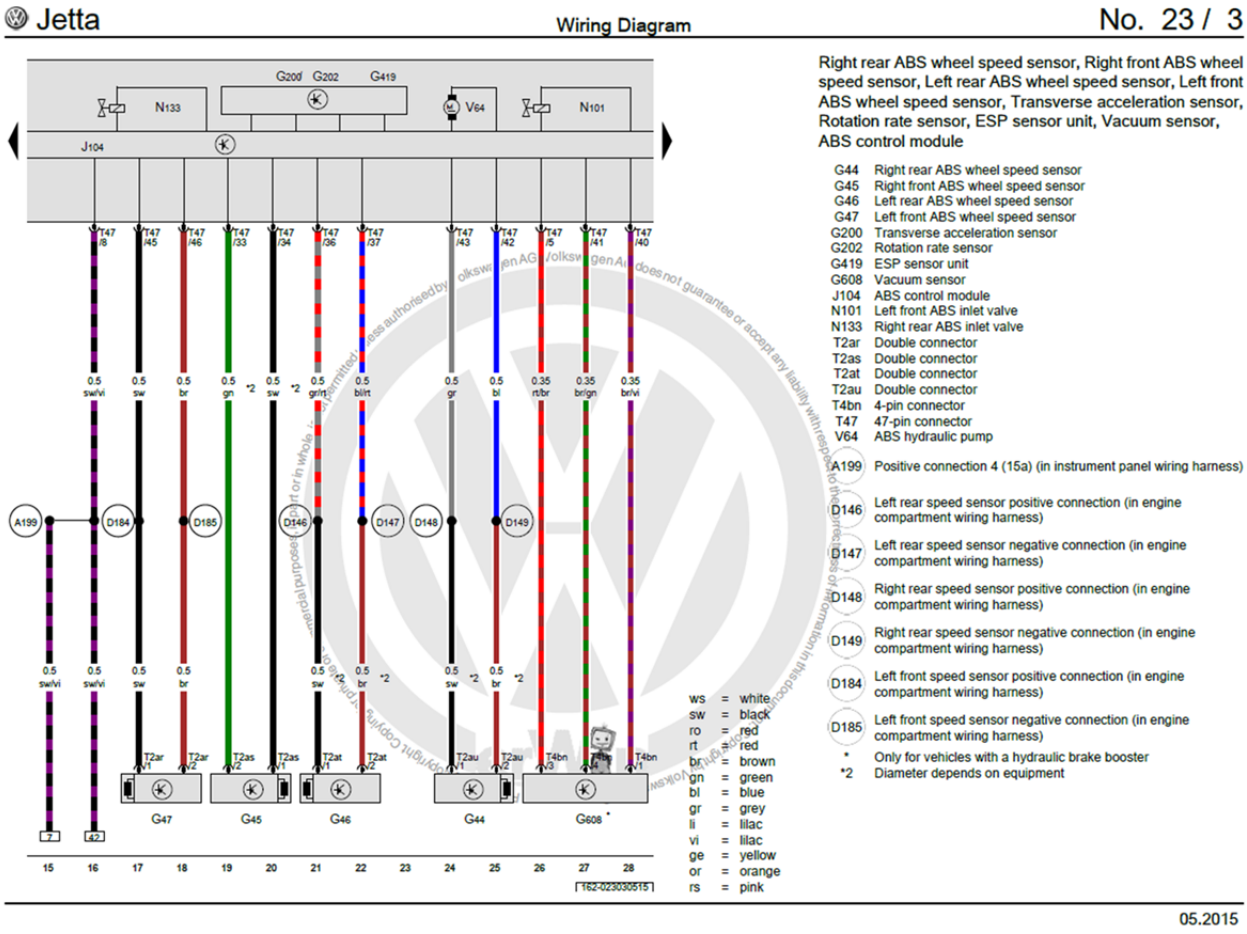


Figure 26

For example, as depicted below, the Manifold Absolute Pressure (MAP) sensors (G71) measure barometric pressure during key on, engine off (KOEO) which is received by the ECM (J623). Also, the Intake Air Temperature Sensor (IATS; G42) senses the temperature of the incoming air which is received by the ECM (J623).

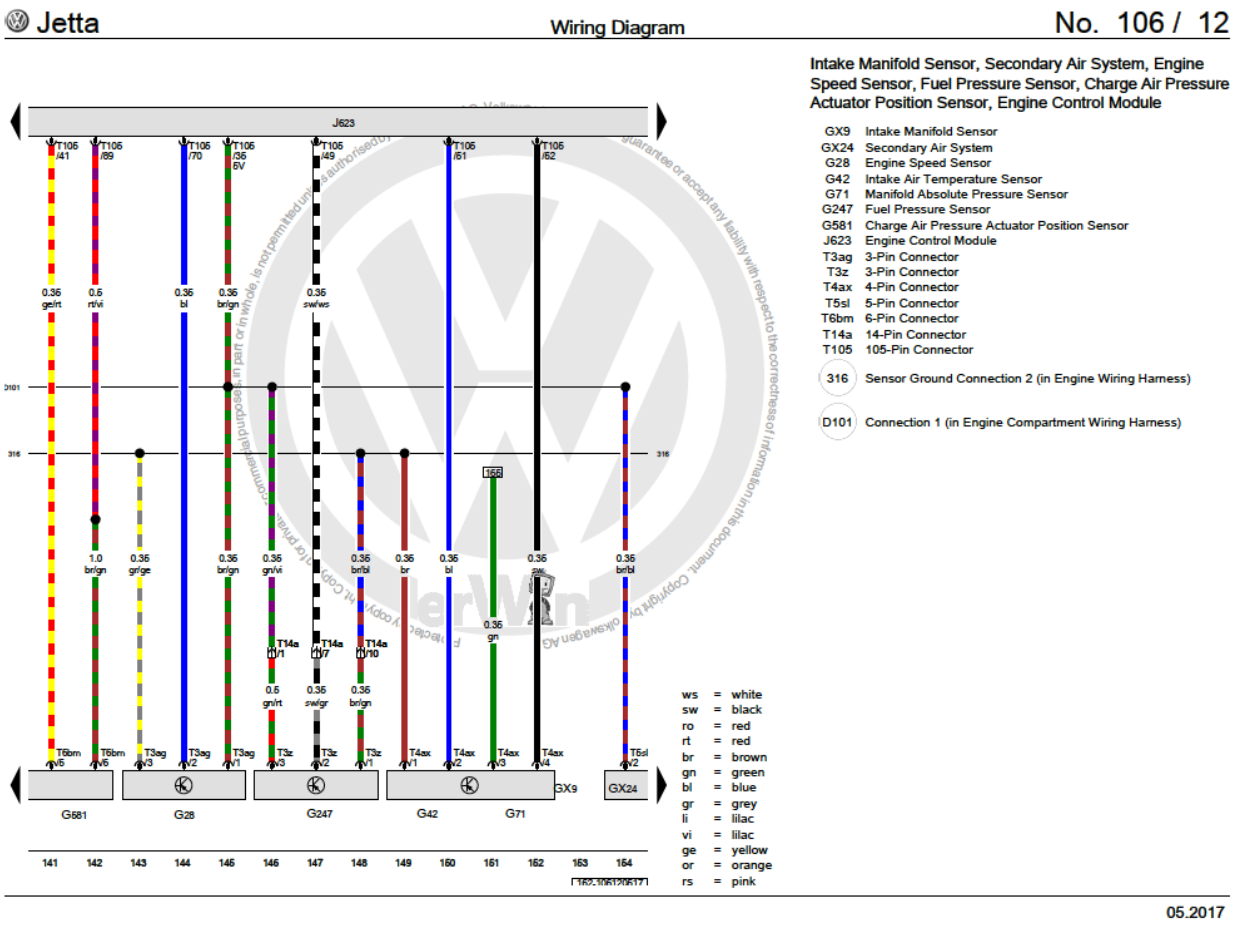


Figure 27

For example, using the Accelerator Pedal Module (GX2), which controls the Accelerator Pedal Position Sensor (G79) and the Accelerator Position Sensor 2 (G185), engine performance commands are sent, via the Engine Control Module (ECM; J623) and the environmental conditions signal(s) are sent using environmental commands from the IATS and MAPS (shown above) which send the environmental conditions signals to the ECM to determine a valve feed forward term.

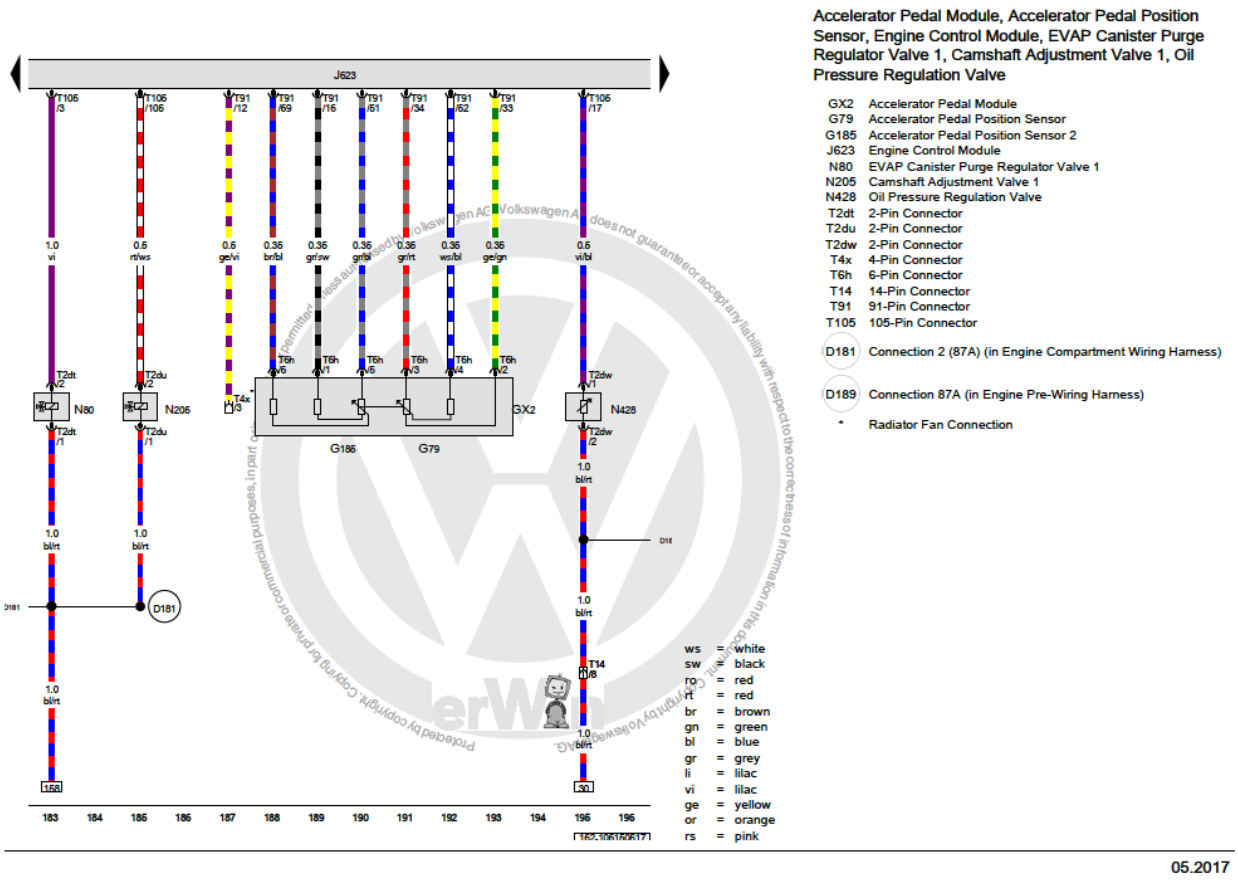


Figure 28

For example, the Engine Control Module (ECM; J623) receives engine performance feedback from various sensors including the engine speed sensor (G28) shown below.

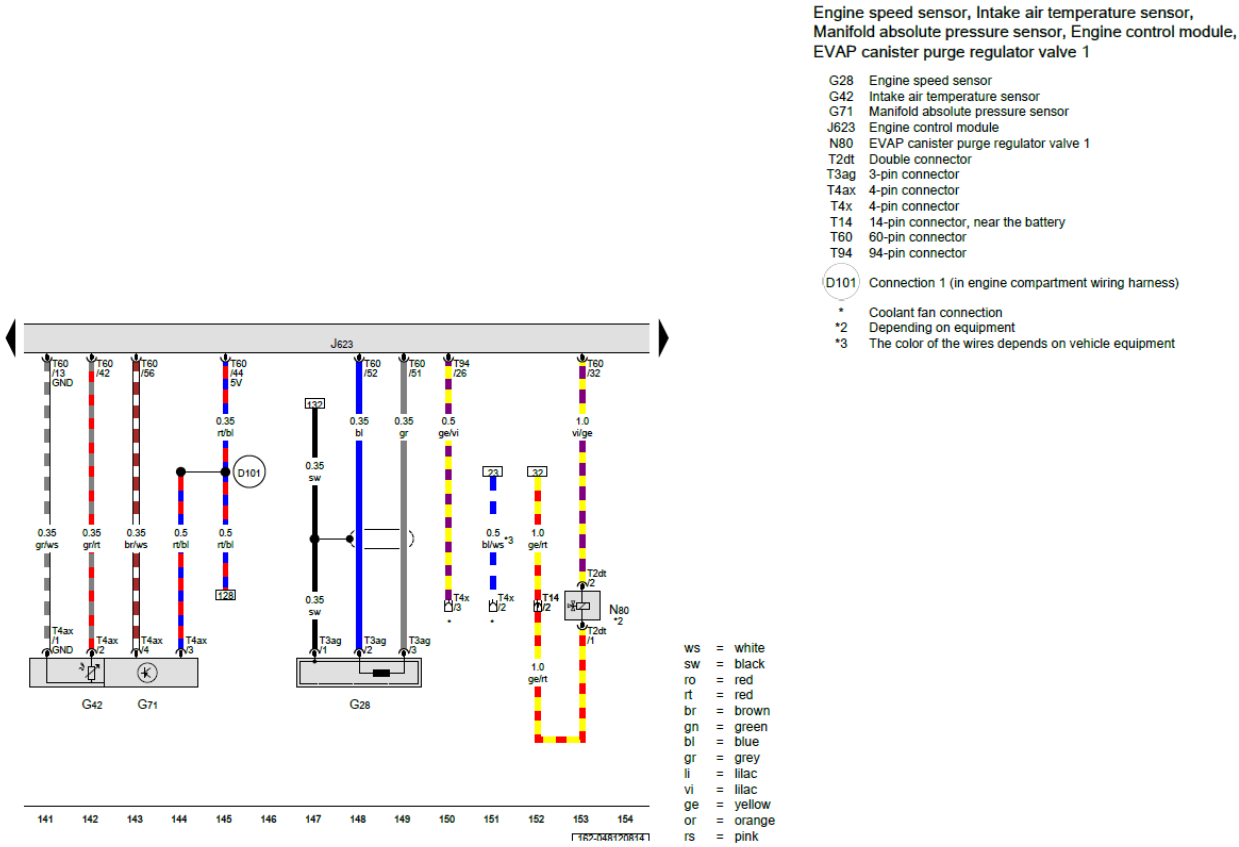


Figure 29

For example, as shown below the ECM (J623) calculates a valve feedback term which is communicated to the camshaft adjustment valve (N205) capable of advancing or retarding the camshaft (adjusting itself) based on a performance command (i.e. from the Accelerator Pedal Module) and the performance feedback (i.e. engine speed sensor (G28 (shown above)).

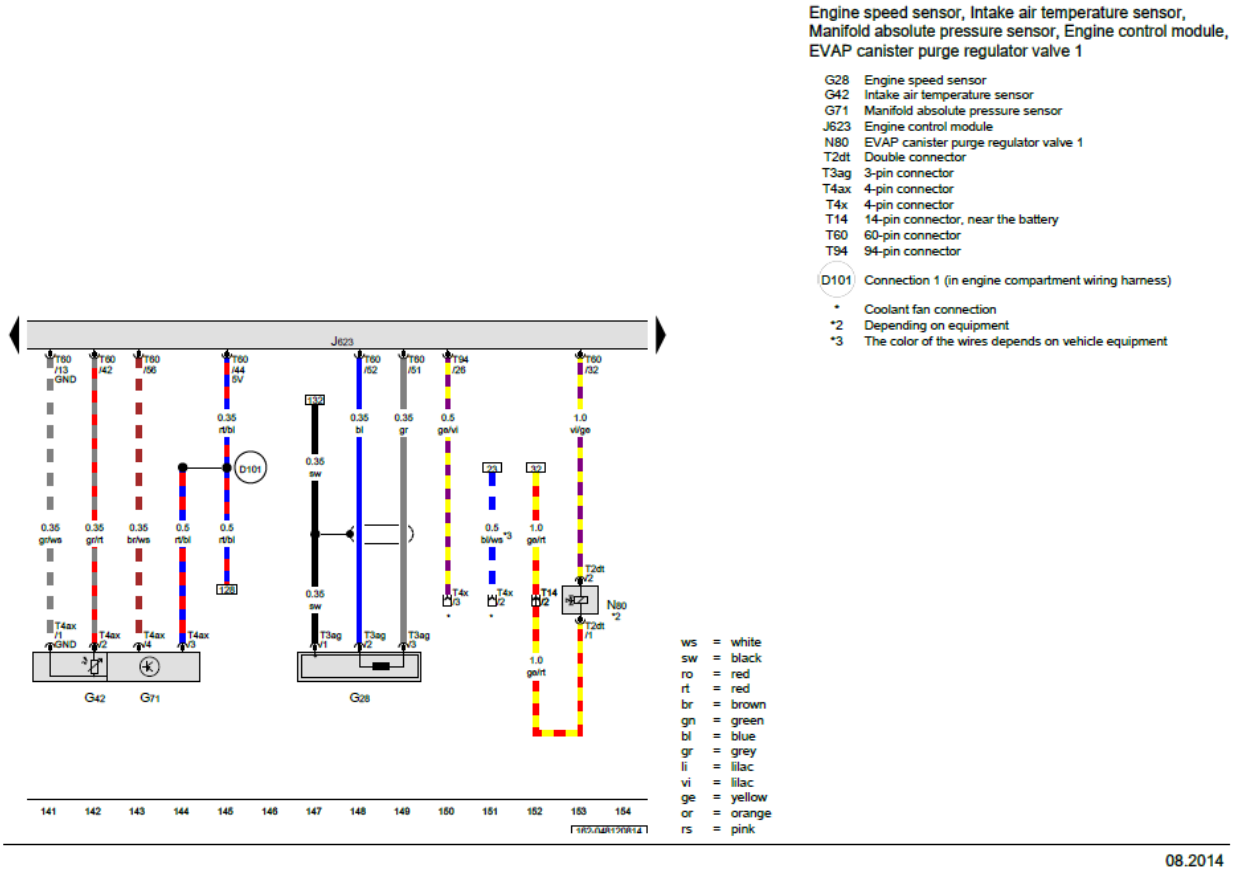


Figure 30

For example, as shown below the ECM (J623) calculates a valve timing command which is communicated to the camshaft adjustment valve (N205) based on data from sensors such as the Accelerator Pedal Position Sensor (G79) and Accelerator Pedal Position Sensor 2 (G185) and the Accelerator Pedal Module (GX2)(feedforward term) and the engine performance based on engine speed sensor input (G28 (shown above)) (valve feedback term).

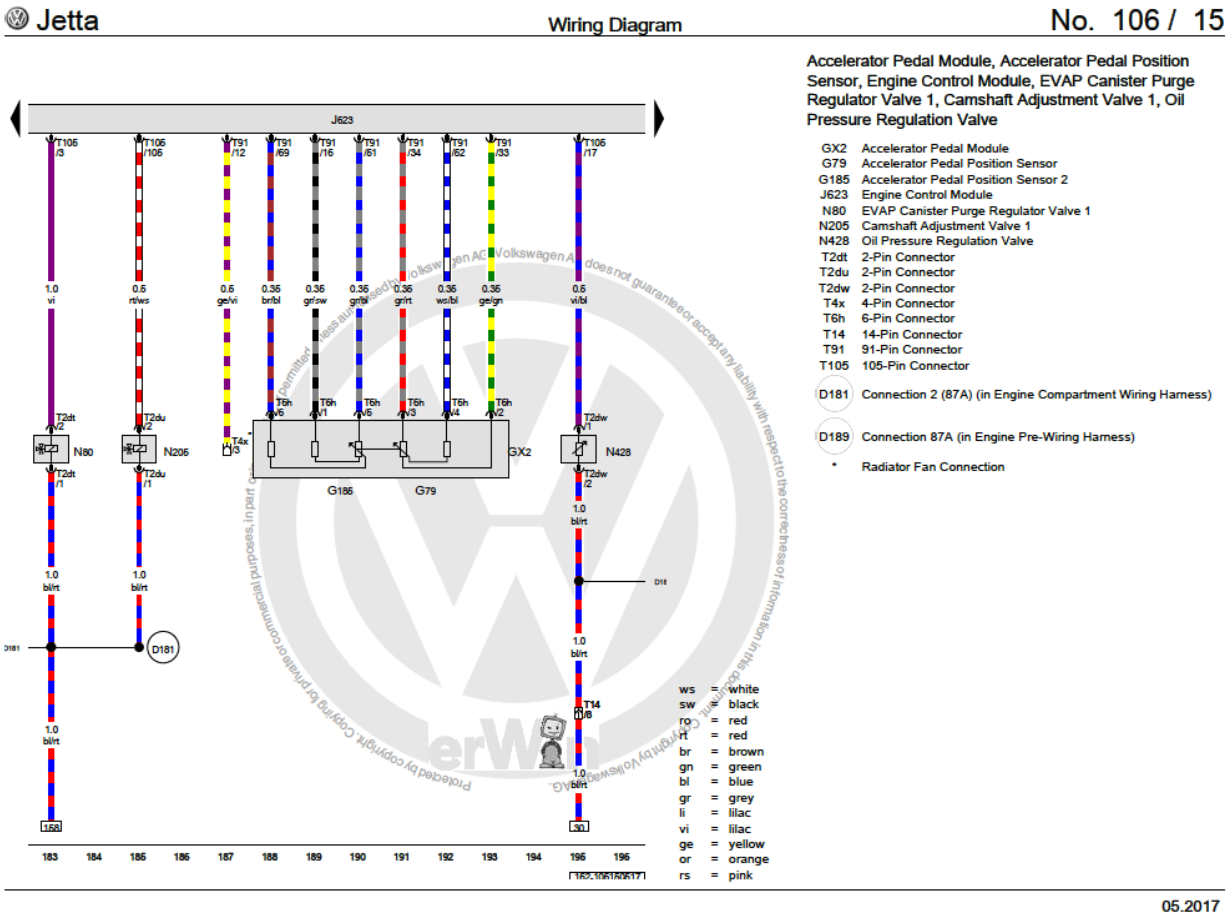


Figure 31

72. In particular, claim 7 of the '540 patent recites the method of claim 1 wherein said receiving an engine performance feedback includes receiving engine speed data.

73. On information and belief, the '540 patent Accused Instrumentalities infringe claim 7 of the '540 patent. The '540 patent Accused Instrumentalities practice the method of claim 1 wherein said receiving an engine performance feedback includes receiving engine speed data (Figure 32).

As shown below, the engine speed sensor (G28) provides engine performance feedback that is sent to the ECM (J623).

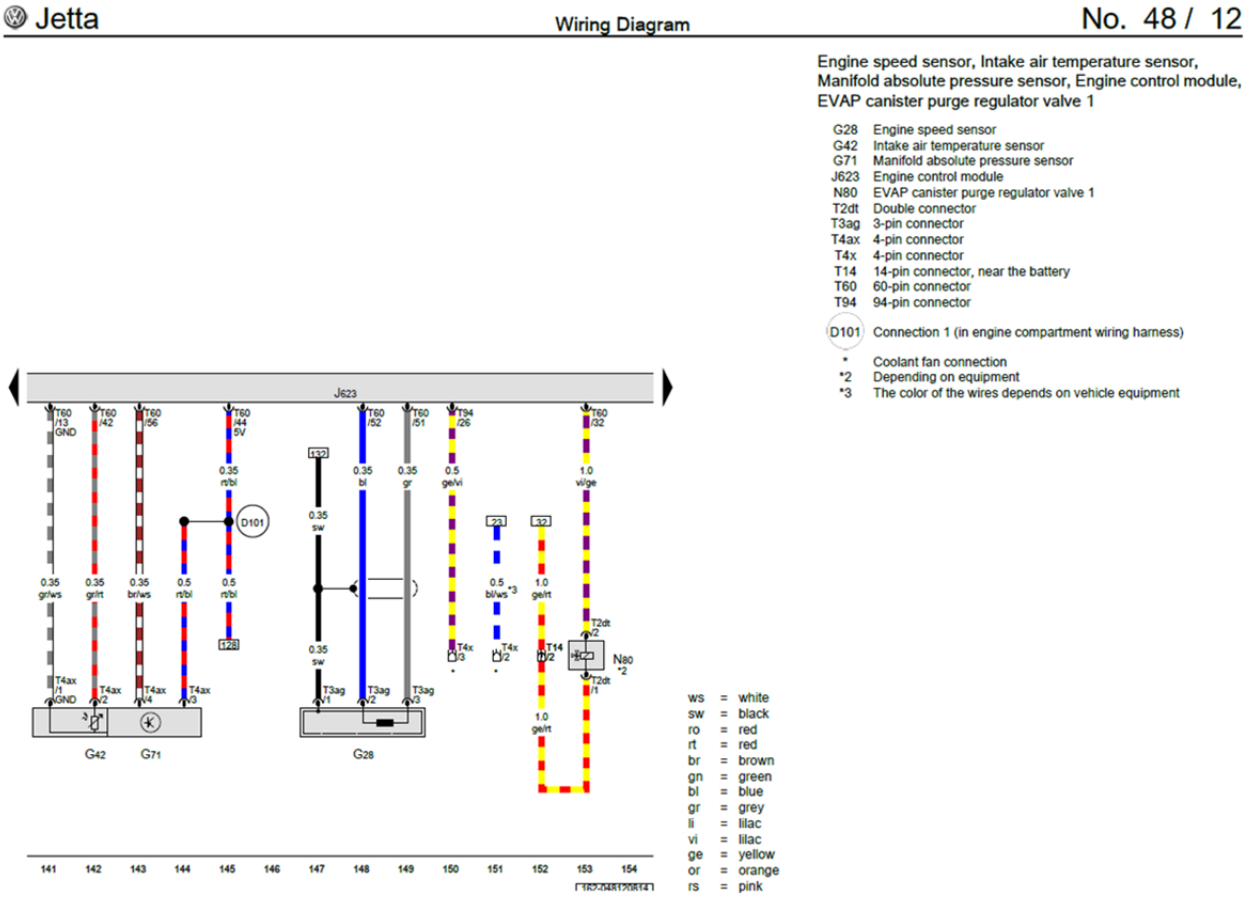


Figure 32

74. In particular, claim 11 of the ’540 patent recites the method of claim 1 further comprising receiving fuel conversion data.

75. On information and belief, the ’540 patent Accused Instrumentalities infringe claim 11 of the ’540 patent. The ’540 patent Accused Instrumentalities practice the method of claim 1 further comprising receiving fuel conversion data (Figure *33*).

For example, the Heated Oxygen Sensor (G39) and the Oxygen sensor after three-way catalytic converter (G130) send fuel conversion data to the ECM (J623).

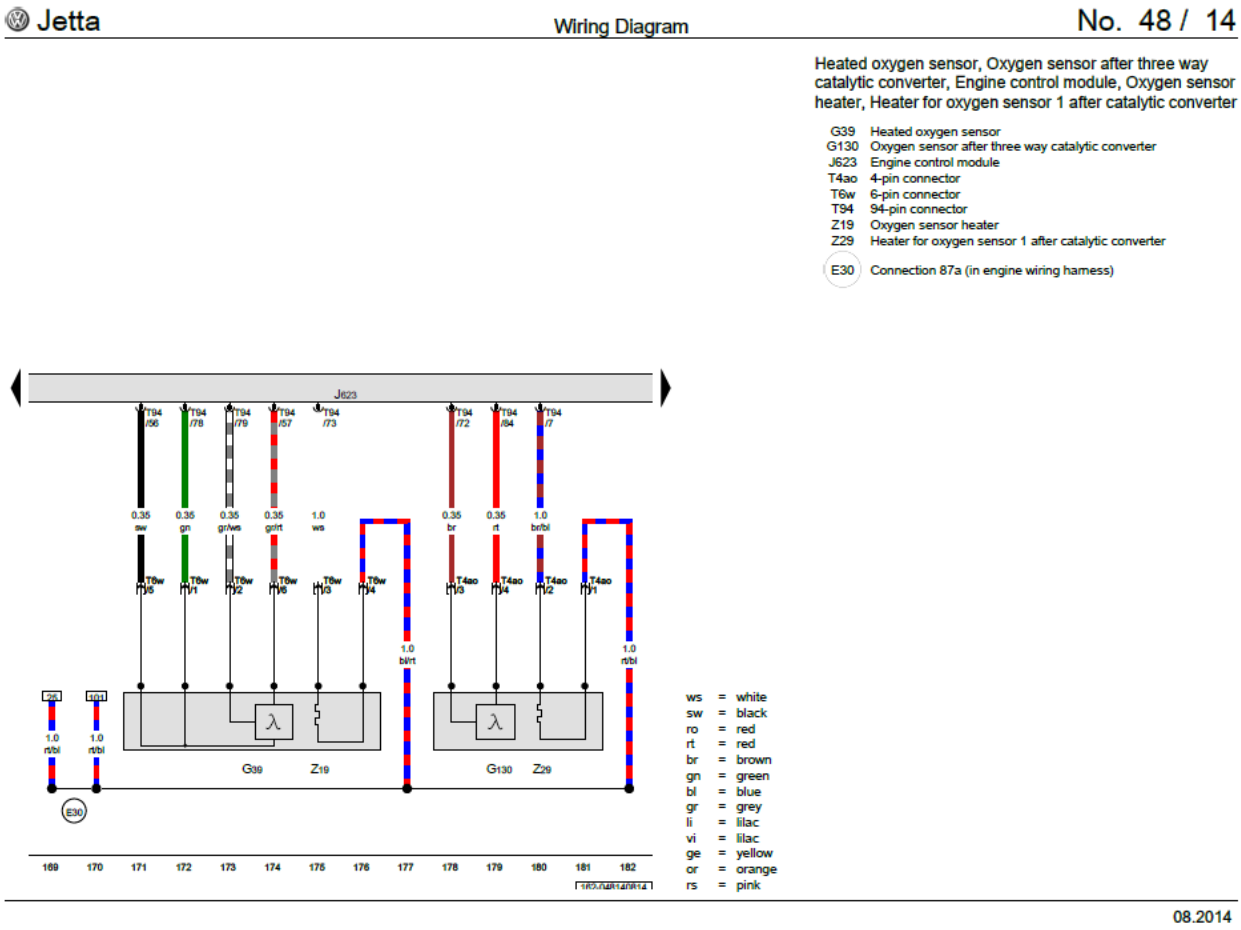


Figure 33

76. In particular, claim 14 of the ’540 patent recites the method of claim 1 further comprising receiving engine emissions data.

77. On information and belief, the ’540 patent Accused Instrumentalities infringe claim 14 of the ’540 patent. The ’540 patent Accused Instrumentalities practice the method of claim 1 further comprising receiving engine emissions data. (Figure 34).

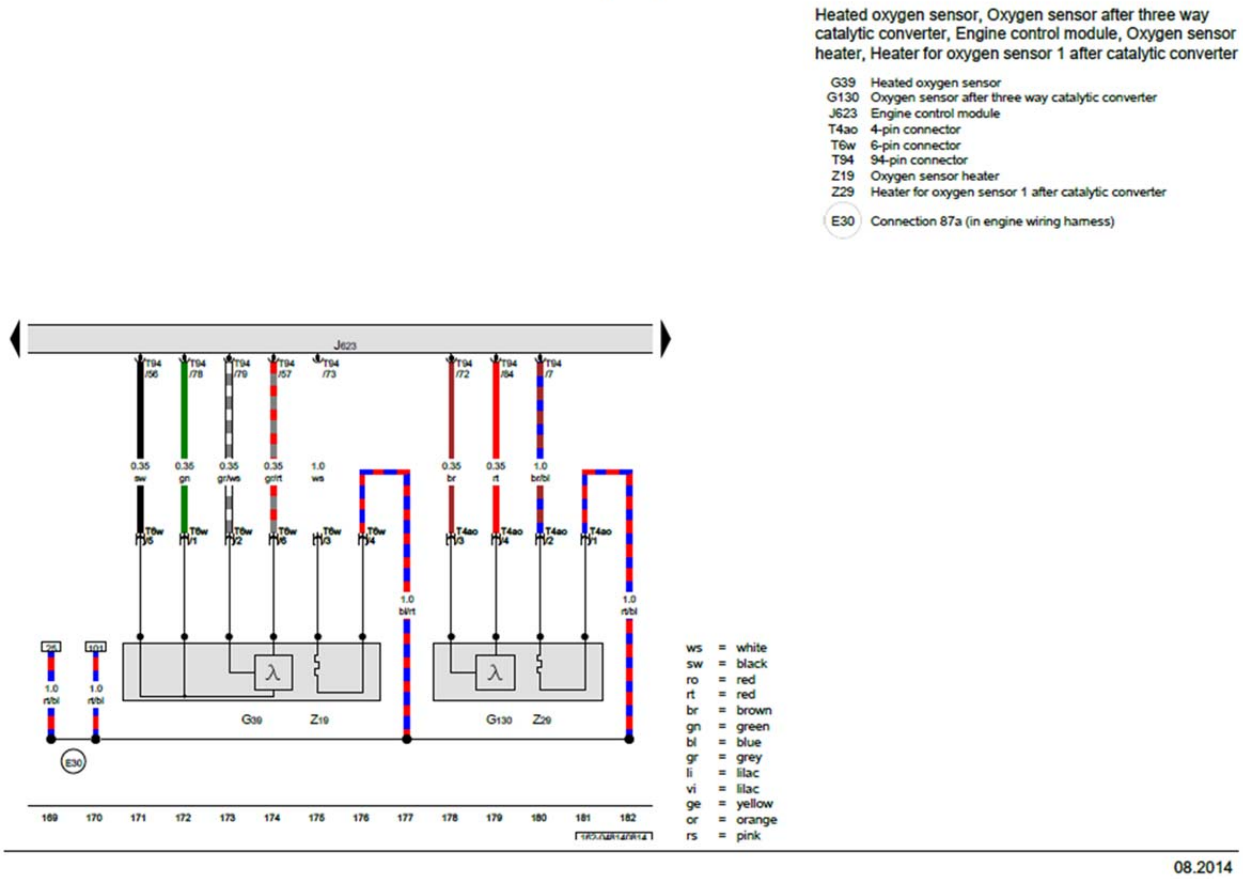


Figure 34

Based upon the totality of the foregoing evidence, and based further upon information and belief, the '540 patent Accused Instrumentalities practice "a method for calculating a valve timing command for an engine of a vehicle, comprising: obtaining an engine performance command; receiving an environmental conditions signal; determining a valve feedforward term based on the engine performance command and the environmental conditions signal; receiving an engine performance feedback; calculating a valve feedback term based on the engine performance command and the engine performance feedback; and calculating a valve timing command based on the valve feedforward term and the valve feedback term."

78. Upon information and belief, the '540 patent Accused Instrumentalities are used, marketed, provided to, and/or used by or for the Defendants' partners, clients and/or customers across the country and in this District.

79. The '540 patent is necessary for the '540 patent Accused Instrumentalities to perform their assigned function.

80. Upon information and belief, Defendants have induced and continue to induce others to infringe at least claims 1, 7, 11, and 14 of the ’540 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including, but not limited to Defendants’ partners, clients and/or customers whose use of the ’540 patent Accused Instrumentalities constitutes direct infringement of at least one claim of the ’540 patent.

81. In particular, the Defendants’ actions that aid and abet others such as its partners, clients and/or customers to infringe include advertising and distributing the ’540 patent Accused Instrumentalities and providing instruction materials, training and services regarding the ’540 patent Accused Instrumentalities.

82. Any party, including Defendants’ partners, clients and/or customers using the ’540 patent Accused Instrumentalities necessarily infringes the ’540 patent because the invention of the ’540 patent is required for the ’540 patent Accused Instrumentalities to work. Defendants advertisements induce others to infringe the ’540 patent. Defendants have knowingly induced infringement since at least receipt of the Previous License Offer Letter prior to August 28, 2017.

83. Upon information and belief, the Defendants are liable as a contributory infringer of the ’540 patent under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States the ’540 patent Accused Instrumentalities that infringe the patented methods, to be especially made or adapted for use in an infringement of the ’540 patent. Each of the Accused Instrumentality is a material component for use in practicing the ’540 patent and is specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

84. Plaintiff has been harmed by Defendants’ infringing activities.

COUNT IV – INFRINGEMENT OF U.S. PATENT NO. 6,736,122

85. The allegations set forth in the foregoing paragraphs 1 through 84 are incorporated into this Fourth Claim for Relief.

86. On May 18, 2004 the '122 patent entitled "Motor Vehicle Engine Synchronization," was duly and legally issued by the United States Patent and Trademark Office. A true and correct copy of the '122 patent is attached as Exhibit 6.

87. Plaintiff is the assignee and owner of the right, title and interest in and to the '122 patent, including the right to assert all causes of action arising under said patents and the right to any remedies for infringement of them.

88. Defendants were made aware of the '574 patent prior to August 28, 2017 when it received the Previous License Offer Letter, and as late as February 19, 2019 when MMT filed its complaint in the Michigan Litigation.

89. Upon information and belief, Defendants have directly infringed at least claim 1 of the '122 patent by making, using, selling, importing and/or providing and causing to be used the 2012-2018 Tiguan, 2012-2018 Audi A3, 2012-2018 Audi A4, 2012-2018 Audi A5, 2012-2018 Audi A6, 2016-2018 Audi TT, 2015-2018 Audi S3, 2015-2018 VW Golf, 2012-2018 VW Golf GTI, 2015-2018 VW Golf R, 2015-2018 Golf Sportwagon, 2013-2018 Jetta GLI, 2014-2018 VW Jetta Sedan, 2014-2018 VW Passat, 2012-2017 WV CC, 2012-2018 VW Beetle, 2018 VW Atlas, 2015- 2018 Audi Q3, 2012-2018 Audi Q5, and 2017-2018 Porsche Macan with the EA888 (the "'122 patent Accused Instrumentalities").

90. In particular, claim 1 of the '122 patent recites an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston, an exhaust conduit, one or more engine operating condition sensors including an exhaust

gas sensor in the exhaust conduit for measuring the composition of the exhaust gas, a fuel injection system, and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder, wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or engine fueling on an incorrect stroke, and the engine management system is arranged to: a) receive from said sensor(s) respective signal(s); b) oscillate the air/fuel ratio between a relatively rich level and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio; c) reverse the direction of change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation; d) determine the temporal characteristics of the oscillation in the air/fuel ratio; and e) determine whether or not the engine is being fueled on the correct stroke by comparing said temporal characteristics with said relevant engine operation data.

91. On information and belief, the ’122 patent Accused Instrumentalities infringe claim 1 of the ’122 patent. The ’122 patent Accused Instrumentalities comprise an internal combustion engine (Figure 35), comprising a number of cylinders (Figure 35), the or each cylinder containing a four-stroke reciprocating piston (Figure 35), an exhaust conduit (Figure 36), one or more engine operating condition sensors including an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas (Figure 37), a fuel injection system (Figures 37-38), and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder (Figure 39), wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or

engine fueling on an incorrect stroke (Figure 39), and the engine management system (Figure 39) is arranged to: a) receive from said sensor(s) respective signal(s) (Figure 40); b) oscillate the air/fuel ratio between a relatively rich level and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio (Figure 41); c) reverse the direction of change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation (Figure 42); d) determine the temporal characteristics of the oscillation in the air/fuel ratio (Figure 42); and e) determine whether or not the engine is being fueled on the correct stroke by comparing said temporal characteristics with said relevant engine operation data (Figure 42).

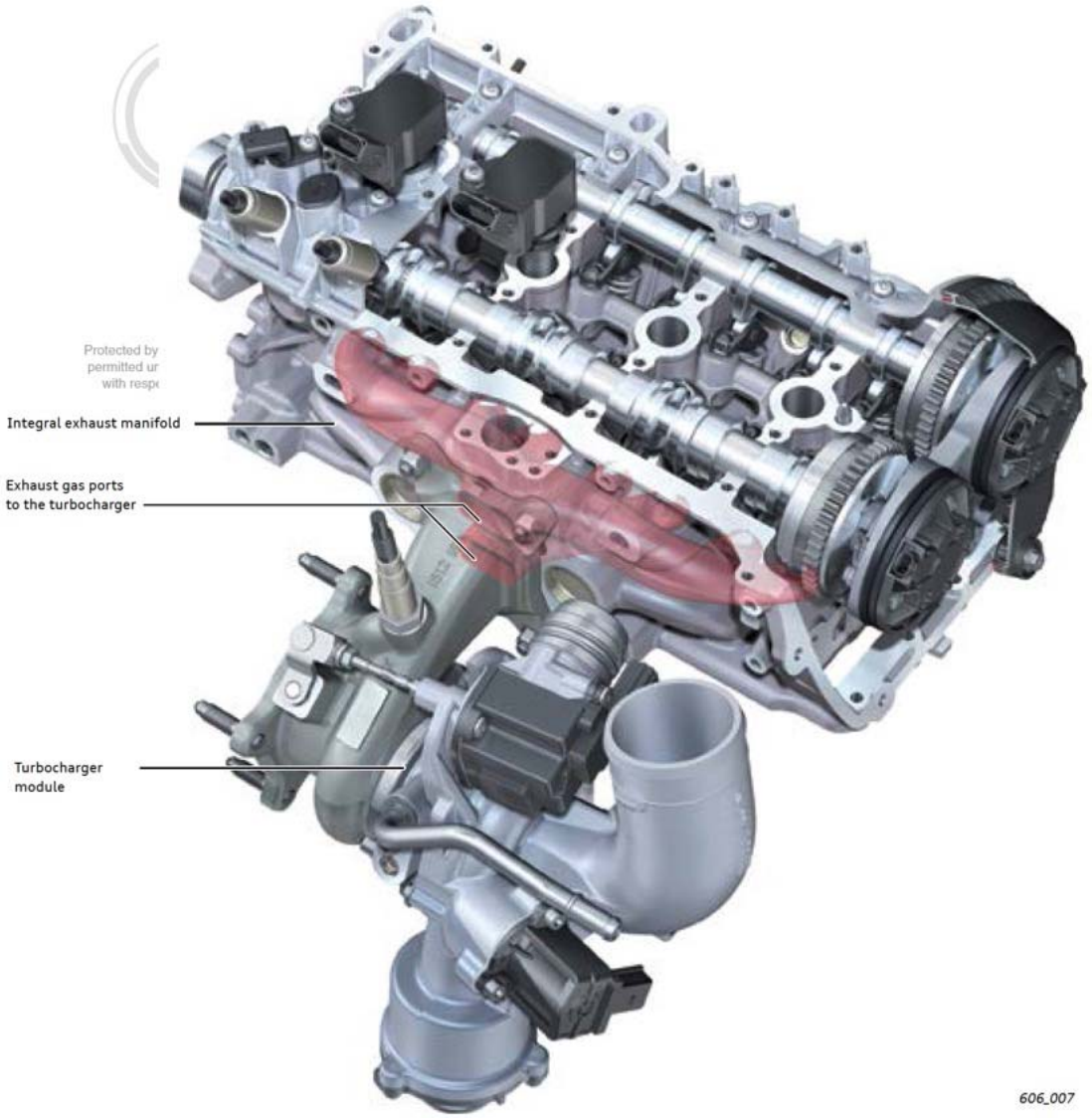
The ’122 patent Accused Instrumentalities comprise an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston.

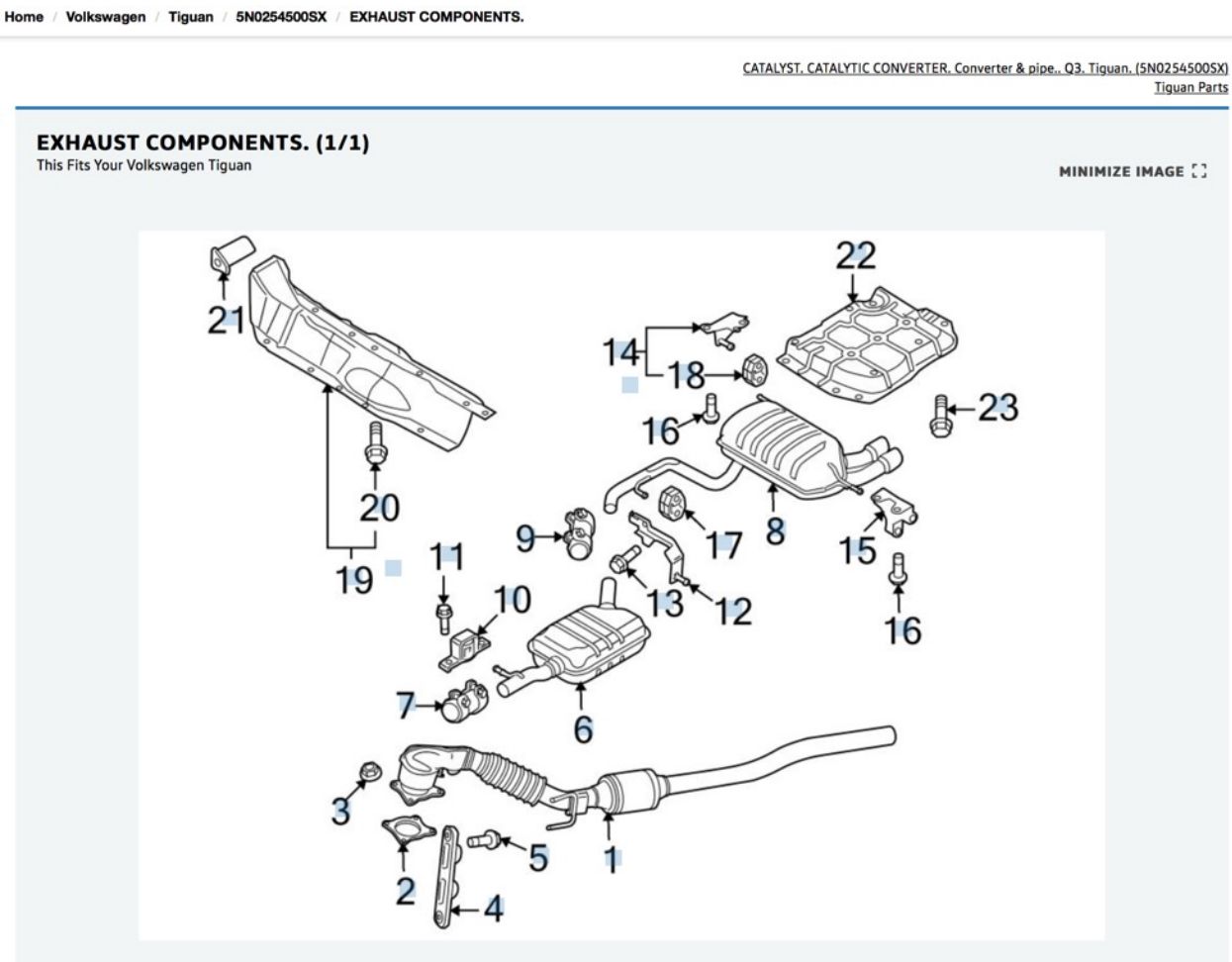
The all-new 2018 Volkswagen Tiguan—the second-generation of the vehicle—is powered by the latest version of the EA888 four-cylinder engine, the 2.0L TSI EA888 Gen3 B-Cycle (Budack-cycle, earlier post), coupled with an 8-speed automatic. This is the only engine/transmission combination available in the Tiguan in the US. 4Motion with Active Control all-wheel drive system is optional. The core element of the new engine is a new combustion process combining short intake events with a high compression ratio.

http://www.greencarcongress.com/2017/06/20170627-tiguan.html

Figure 35

As depicted below, the integrated exhaust manifold is part of the exhaust conduit.


Protected by
permitted ur
with respe
Integral exhaust manifold
Exhaust gas ports
to the turbocharger
Turbocharger
module
606_007



https://parts.vw.com/a/Volkswagen__Tiguan/48838109__5962725/EXHAUST-COMPONENTS/9245245.html

Figure 36

As shown below, the oxygen sensor is an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas.

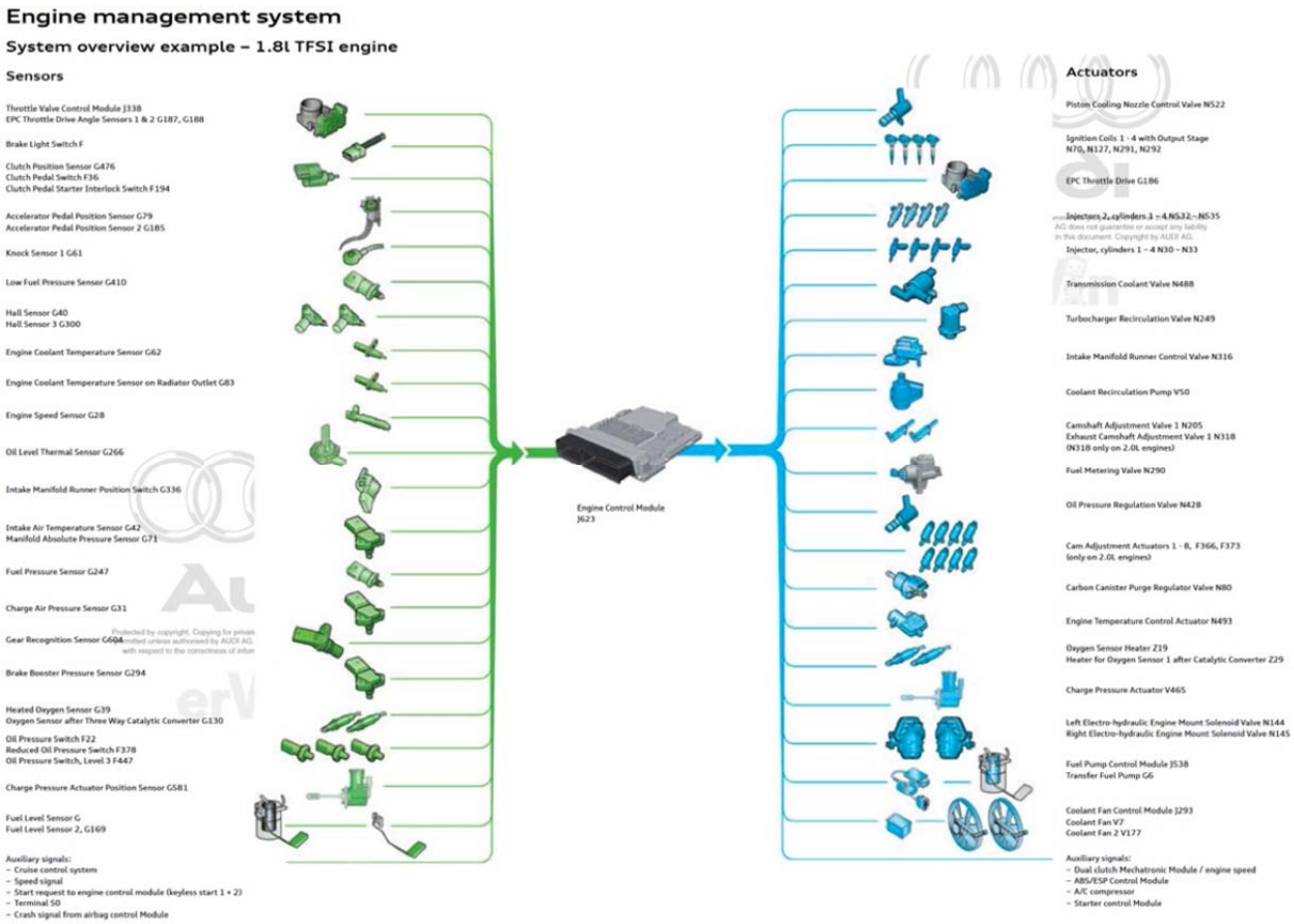


Figure 37

As shown below, the Multiport Fuel Injection System (MFI) is a fuel injection system.

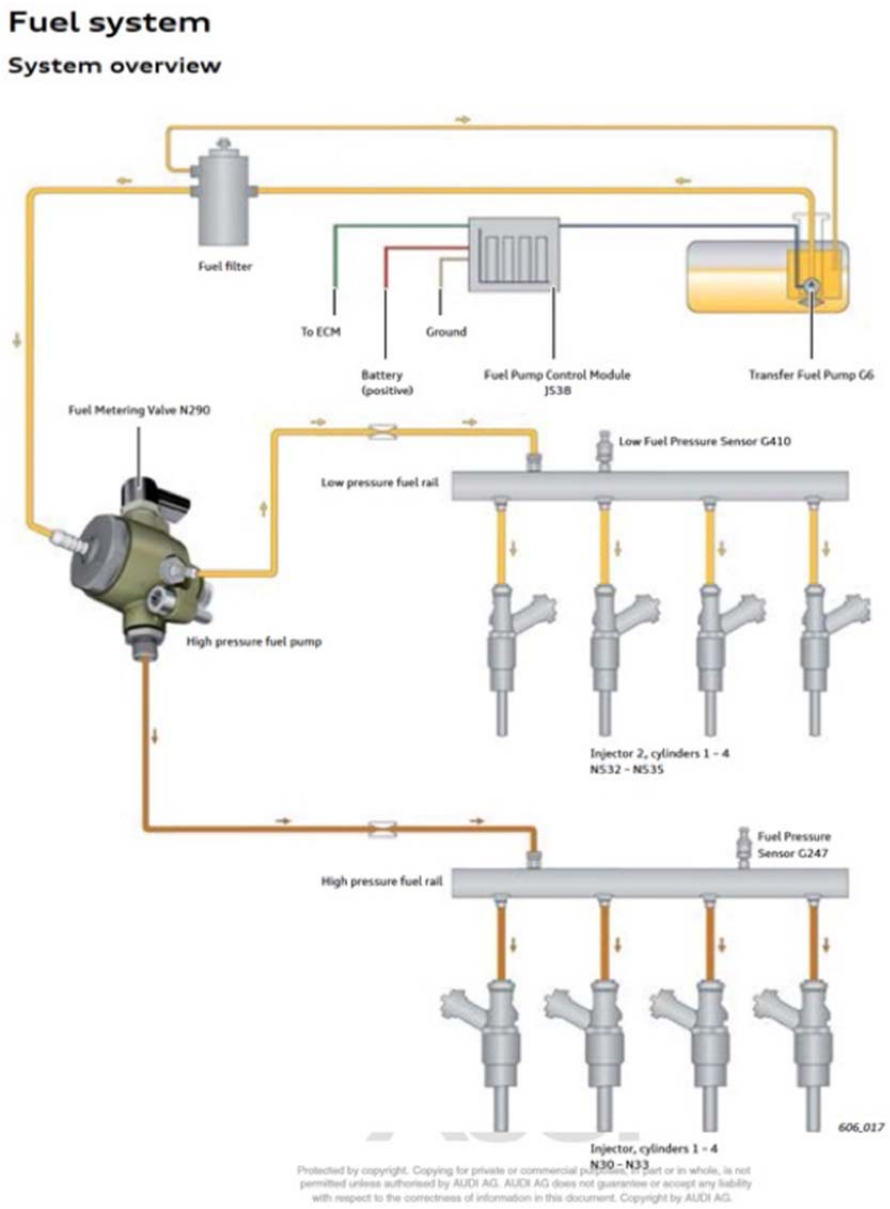


Figure 38

As shown below, the Engine Control Module (ECM) is an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder. The PCM monitors and determines the air/fuel mixture. The sensors provide engine operation data to the engine management system. The engine operation data related to expected engine operation (whether or not proper combustion of the engine is achieved or not) with engine fueling on the correct stroke (i.e. combustion) and/or engine fueling (fuel injection time) on an incorrect stoke (monitored proper combustion) by the Engine Control Module (ECM).

Upon information and belief, information related to the terms "fueling on the correct stroke" or "fueling on an incorrect stroke" is not publicly available, and only in the possession of Volkswagen. However, in my opinion this element is highly likely present in the '122 patent

Accused Instrumentalities. This information is highly likely to be contained in the software from the ECM.

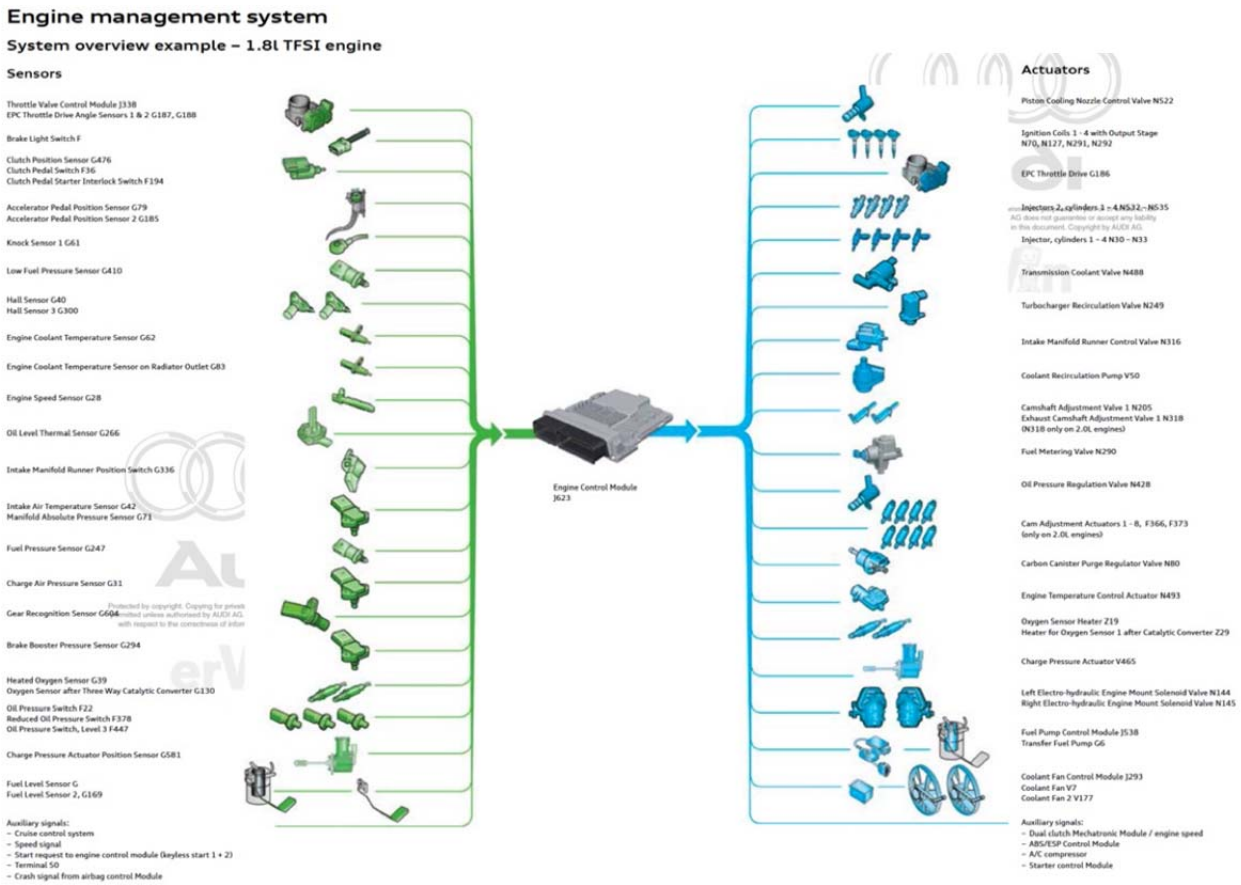


Figure 39

The ’122 patent Accused Instrumentalities comprise an engine management system is arranged to receive from said sensor(s) respective signal(s).

For example, as shown below, the ECM receives signals from the sensors.

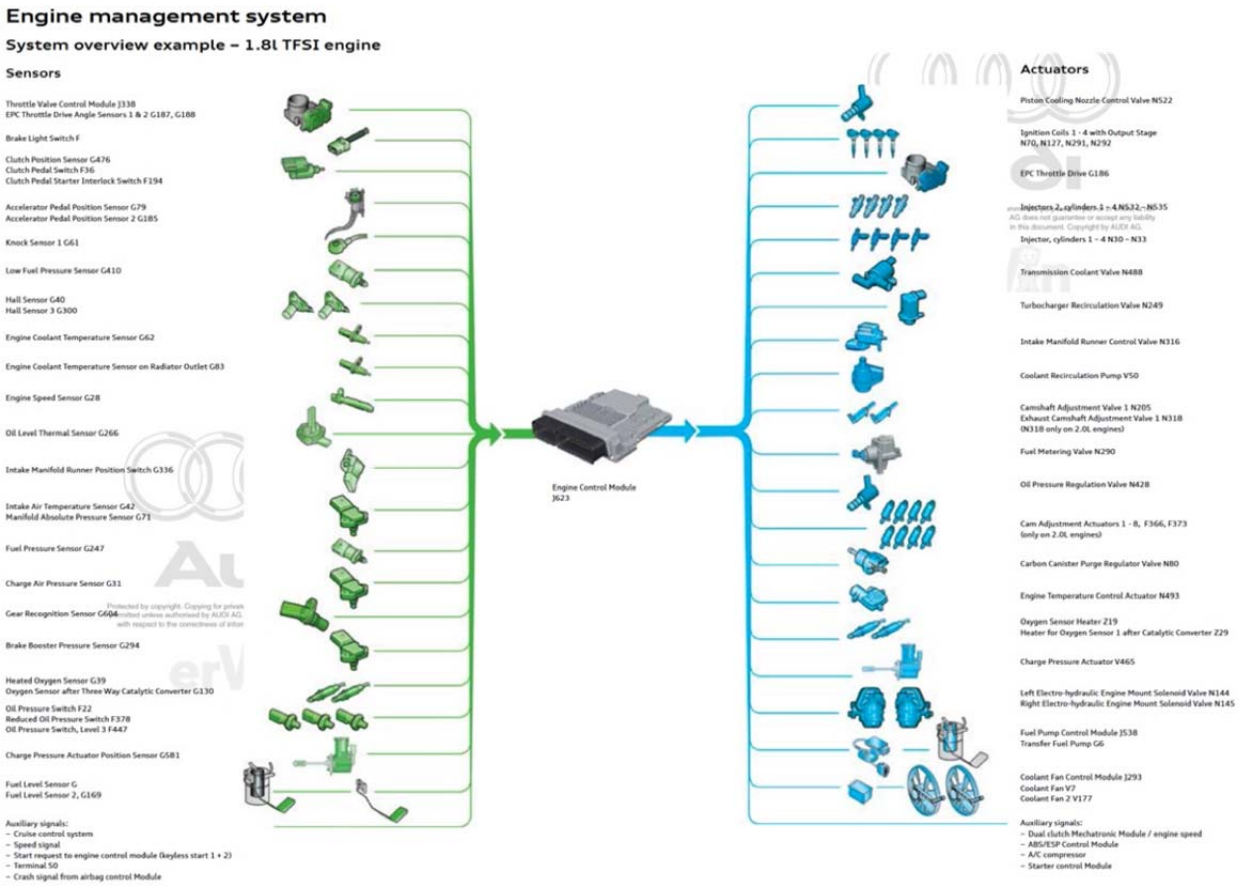


Figure 40

For example, as shown below, the engine management system oscillates the air/fuel ratio (the PCM increases or decrease fuel injection duration) depending on the air/fuel ratio (measured by the oxygen sensor in the exhaust stream) as measured by the exhaust gas oxygen sensors (8 & 9).

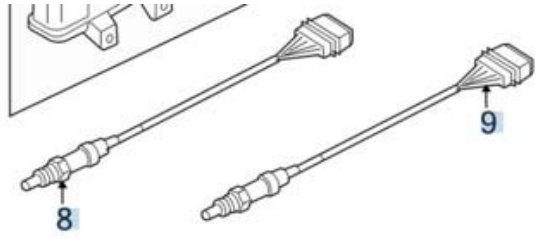


Figure 41

As exemplified below, the PCM reverses the direction of change of the air/fuel ration (from rich to lean, or lean to rich) when the exhaust gas composition sensed (measured by the oxygen sensor in the exhaust stream) as being indicative of rich engine operation or lean engine operation (detects a wide range of air fuel ratios; closed-loop fuel control operation changes direction between rich and lean). When this occurs at too slow of a rate from rich to lean, the

PCM sets DTC P0139. The temporal characteristics (the measured amplitude versus the amplitude of a slow sensor) of the oscillation in the air/fuel ratio (oscillates between rich and lean). The PCM monitors the switch rate frequency of the exhaust gas oxygen sensors between rich and lean and vice versa and is capable of determining when the frequency is not correct.

2015 Volkswagen Tiguan 4Motion (5N2) L4-2.0L Turbo (CCTA)

Vehicle » A L L Diagnostic Trouble Codes (DTC) » Testing and Inspection » P Code Charts » P0139 » Engine Control Module, 2015 MY

ENGINE CONTROL MODULE, 2015 MY

Engine Control Module, 2015 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			For time > 10.0 Sec General : Engine running Dew point exceeded Lambda set value > 0.995			
P0139 O2 Sensor Circuit Slow Response Bank 1 Sensor 2	O2 Sensor Circuit Slow Response Bank 1 Sensor 2	EWMA filtered transient time at fuel cutoff > 0.0 s In voltage range of 201 - 401 mV Number of checks, >= 3	Rich voltage enable > = 547.9 mV Lean voltage < = 201.2 mV Fuel cutoff active O2S rear ready Modeled exhaust gas temp > 400 °C Front HO2S sensor lambda signal > 2.00 V	100.0 s	1 DCY	Check the Oxygen Sensor 1 After Catalytic Converter (GX7) . Refer to ⇒ [Oxygen Sensor 1 After Catalytic Converter (GX7), Checking].

Upon information and belief, a determination whether or not the engine is being fueled on the correct stroke is determined by the ECM and the MFI wherein temporal characteristics (shown above) are compared with relevant engine operation data (shown above).

Based upon the totality of the foregoing evidence, and based further upon information and belief, the ’122 patent Accused Instrumentalities include “an internal combustion engine, comprising a number of cylinders, the or each cylinder containing a four-stroke reciprocating piston, an exhaust conduit, one or more engine operating condition sensors including an exhaust gas sensor in the exhaust conduit for measuring the composition of the exhaust gas, a fuel injection system, and an engine management system for controlling the operation of the engine including the fuel injection system and the air/fuel ratio for at least one cylinder, wherein the engine management system contains engine operation data, the engine operation data being related to expected engine operation with engine fueling on the correct stroke and/or engine fueling on an incorrect stroke, and the engine management system is arranged to: a) receive from said sensor(s) respective signal(s); b) oscillate the air/fuel ratio between a relatively rich level and a relatively lean level, the exhaust gas composition varying depending on the air/fuel ratio; c) reverse the direction of

change of the air/fuel ratio when the exhaust gas composition is sensed as being indicative of rich engine operation or lean engine operation; d) determine the temporal characteristics of the oscillation in the air/fuel ratio; and e) determine whether or not the engine is being fueled on the correct stroke by comparing said temporal characteristics with said relevant engine operation data."

Figure 42

92. Upon information and belief, the '122 patent Accused Instrumentalities are used, marketed, provided to, and/or used by or for the Defendants' partners, clients and/or customers across the country and in this District.

93. The '122 patent is necessary for the '122 patent Accused Instrumentalities to perform their assigned function.

94. Upon information and belief, Defendants have induced and continue to induce others to infringe at least claims 1 of the '122 patent under 35 U.S.C. § 271(b) by, among other things, and with specific intent or willful blindness, actively aiding and abetting others to infringe, including, but not limited to Defendants' partners, clients and/or customers whose use of the '122 patent Accused Instrumentalities constitutes direct infringement of at least one claim of the '122 patent.

95. In particular, the Defendants' actions that aid and abet others such as its partners, clients and/or customers to infringe include advertising and distributing the '122 patent Accused Instrumentalities and providing instruction materials, training and services regarding the '122 patent Accused Instrumentalities.

96. Any party, including Defendants' partners, clients and/or customers using the '122 patent Accused Instrumentalities necessarily infringes the '122 patent because the invention of the '122 patent is required for the '122 patent Accused Instrumentalities to work. Defendants

advertisements induce others to infringe the ’122 patent. Defendants have knowingly induced infringement since at least receipt of the Previous License Offer Letter prior to August 28, 2017.

97. Upon information and belief, the Defendants are liable as a contributory infringer of the ’122 patent under 35 U.S.C. § 271(c) by offering to sell, selling and importing into the United States the ’122 patent Accused Instrumentalities that infringe the patented methods, to be especially made or adapted for use in an infringement of the ’122 patent. Each of the Accused Instrumentality is a material component for use in practicing the ’122 patent and is specifically made and are not a staple article of commerce suitable for substantial non-infringing use.

98. Plaintiff has been harmed by Defendants’ infringing activities.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff demands a trial by jury on all issues triable as such.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff demands judgment for itself and against Defendants as follows:

A. An adjudication that Defendants have infringed the ’497, ’574, ’540, and ’122 patents;

B. An award of damages to be paid by Defendants adequate to compensate Plaintiff for Defendants’ past infringement of the ’497, ’574, ’540, and ’122 patents and any continuing or future infringement through the date such judgment is entered, including interest, costs, expenses and an accounting of all infringing acts including, but not limited to, those acts not presented at trial;

C. A declaration that this case is exceptional under 35 U.S.C. § 285, and an award of Plaintiff’s reasonable attorneys’ fees; and

D. An award to Plaintiff of such further relief at law or in equity as the Court deems just and proper.

Dated: August 27, 2020

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